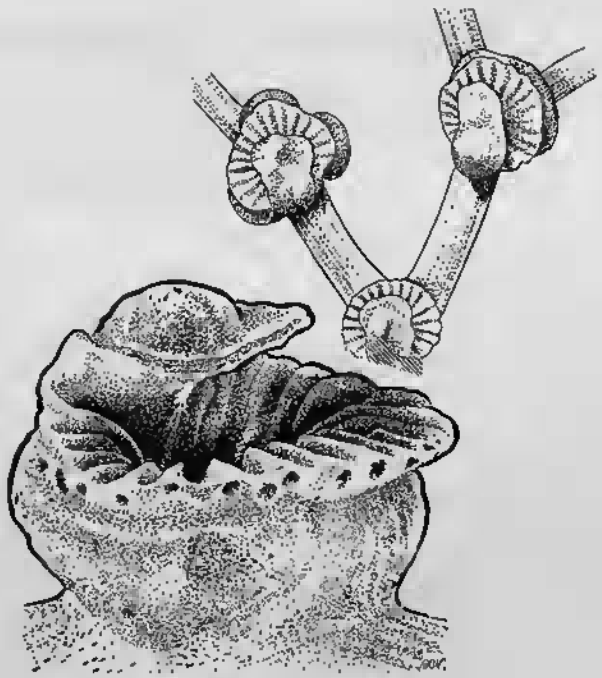
Revision of the northeast Atlantic and Mediterranean Stylasteridae (Cnidaria: Hydrozoa)



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ABSTRACT

ZIBROWIUS H. & S. D. CAIRNS, 1992. *REVISION OF THE NORTHEAST ATLANTIC AND MEDITERRANEAN STYLASTERIDAE (CNIDARIA: HYDROZOA). Mém. Mus. natn. Hist. nat.*, (A), **153**: 1-136. Paris ISBN: 2-85653-192-X.
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In the northeastern Atlantic, from the Cape Verde Islands to the Mid-Atlantic Ridge at 23°31'N, the Azores, Iceland and northern Scandinavia, 19 species of stylasterids have been recognized, one of which is represented by 3 subspecies. Complementary records extend the study area to Greenland. In addition, 2 species are included from the islands of the Gulf of Guinea, equatorial eastern Atlantic. Of all these species and subspecies, 20 are fully described whereas 3 that are incompletely known, are not yet named. The new taxa are: *Pliobothrus gracilis* n. sp., *Stylaster maroccanus* n. sp., *S. ibericus* n. sp., *S. erubescens groenlandicus* n. ssp., *S. erubescens britannicus* n. ssp., *S. erubescens meteorensis* n. ssp., *Crypthelia medioatlantica* n. sp., and *C. vascomarquesi* n. sp.

Compared with the scleractinian corals present in the same areas, most of the studied stylasterid species appear to have a rather narrow geographical range. Only 3 of the 21 species (15 %) recorded from the northeastern and equatorial eastern Atlantic are known in the western Atlantic.

Although covering a much wider area, the northeastern Atlantic stylasterid fauna is considerably less diversified than its West Indian counterpart, which comprises about twice as many species in 8 genera. Among the northeastern Atlantic regional faunas, that of the Azores is the richest, with 9 deep-water species. Only one species (*Errina aspera*) occurs in the southwestern Mediterranean.

Although present in the islands of the Gulf of Guinea, shallow-water stylasterids are missing in the northeastern Atlantic and Mediterranean where the shallowest records are from about 100 m. A few records exceed depths of 2000 m.

In the study area various symbionts leave characteristic traces on the stylasterid skeleton or cause modifications: the gastropod genus *Pedicularia* (on 8 species) and polynoid and eunicid polychaetes (each on one species).

The reliable record of fossil stylasterids is scarce in Europe and the Mediterranean basin (as it is elsewhere). It ranges from the Lower Paleocene to the Plio-Pleistocene whereas *Pedicularia*, an obligate symbiont of stylasterids, is known from the Messinian (Upper Miocene) and from the Lower Pleistocene.

Source : MNHN, Paris

RÉSUMÉ

ZIBROWIUS H. & S. D. CAIRNS, 1992. *REVISION OF THE NORTHEAST ATLANTIC AND MEDITERRANEAN STYLASTERIDAE (CNIDARIA: HYDROZOA). Mém. Mus. natn. Hist. nat.*, (A), **153**: 1-136. Paris ISBN: 2-85653-192-X.
Publié le 20 Mars 1992.

Révision des Stylasteridae de l'Atlantique nord-oriental et de la Méditerranée. Dans l'Atlantique nord-oriental, des îles du Cap-Vert á la dorsale Médio-Atlantique par 23°31'N, aux Açores, á l'Islande et au nord de la Scandinavie, 19 espéces de Stylasteridae ont été reconnues, dont une représentée par 3 sous-espéces. Des signalisations complémentaires étendent la zone étudiée jusqu'au Groenland. En plus, sont inclues ici 2 espéces des îles du golfe de Guinée, Atlantique équatorial oriental. De toutes ces espéces et sous-espéces, 20 sont décrites en détail tandis que 3 autres, incomplètement connues, n'ont pas encore reçu de nom. Les nouveaux taxa sont: *Pliobothrus gracilis* n. sp., *Stylaster maroccanus* n. sp., *S. ibericus* n. sp., *S. erubescens groenlandicus* n. ssp., *S. erubescens britannicus* n. ssp., *S. erubescens meteorensis* n. ssp., *Crypthelia medioatlantica* n. sp., *C. vascomarquesi* n. sp.

Les auteurs du 18e siécle connaissaient trois espéces: deux en provenance des fjords de Norvége, et une obtenue en Méditerranée par les pêcheurs du corail rouge. Avant la fin du 19e siécle, du matériel de la plupart des espéces avait été récolté, y compris par les expéditions du " *Challenger* ", du " *Talisman* " et du Prince de Monaco. Mais au-delá de notes dispersées (dont notamment celles de H. BOSCHMA) á propos de quelques espéces, l'ensemble de cette faune n'avait jamais été l'objet d'une synthése. Trois espéces avaient même été décrites á titre de bryozoaires (" *Hornera* ").

La syntbèse présentée ici s'appuie aussi sur de nombreuses campagnes océanographiques plus récentes (y compris des prélévements par submersibles), telles que les campagnes BIAÇORES, BALGIM, SEAMOUNT 1, HYDROSNAKE et celles de la " *Thalassa* ".

Pour la plupart, les espéces étudiées semblent avoir une répartition géographique assez étroite, comparé á celle des scléractiniaires présents dans les mêmes zones. Seulement 3 espéces sur 21 (15 %) inventoriées dans l'Atlantique nord-oriental et équatorial oriental sont connues aussi dans l'Atlantique occidental. Aucune de ces espéces atlantiques ne semble exister dans les autres océans. Tout comme les scléractiniaires, les Stylasteridae sont absents au-delá de la périphérie du bassin arctique, ce qui contraste avec la diversité des deux groupes dans l'océan Antarctique aux conditions plus stables depuis des millions d'années.

La faune de Stylasteridae de l'Atlantique nord-oriental est considérablement moins diversifiée que celle de l'Atlantique tropical américain qui comprend environ deux fois plus d'espéces dans 8 genres. Parmi les faunes régionales, celle des Açores est la plus riche, avec 9 espéces de profondeur. Une seule espéce (*Errina aspera*) vit dans la Méditerranée et y est limitée á la partie sud-occidentale. Elle est typique de fonds rocheux exposés á de forts courants (détroit de Messine, détroit de Gibraltar).

Des Stylasteridae littoraux ou de faible profondeur existent aux îles du golfe de Guinée, mais sont absents de l'Atlantique nord-oriental et de la Méditerranée oú les signalisations les moins profondes correspondent á environ 100 m de profondeur. De rares récoltes correspondent á des profondeurs dépassant 2000 m, dont une par le submersible " *Nautile* " sur la dorsale Médio-Atlantique.

Dans la zone étudiée divers symbiontes laissent des traces caractéristiques sur le squelette des Stylasteridae ou causent des modifications: gastropodes prosobranches du genre *Pedicularia* (sur 8 espéces) et polychétes Polynoidae et Eunicidae (chacun sur une espéce). Le contour de la coquille de *Pedicularia* correspond étroitement á la configuration et aux irrégularités de la branche á l'endroit occupé. Aprés la disparition du symbionte cet emplacement précis reste évident par un dépôt de calcaire. Les galles induites par des Polynoidae, formant des galeries le long des branches et á orifices latérales, sont exceptionnellement rares dans l'Atlantique nord-oriental. *Eunice norvegica*, symbionte d'une espéce de Stylasteridae aux Açores, est le même qu'on trouve dans des colonies de scléractiniaires (*Lophelia, Madrepora, Solenosmilia*). Son tube souple d'une matiére organique est recouvert de la même façon par le sclérenchyme de l'bydrocoralliaire.

Les signalisations fiables de Stylasteridae á l'état fossile pour l'Europe et le bassin méditerranéen sont rares (comme elles le sont aussi ailleurs). Elles vont du Paléocéne inférieur au Plio-Pléistocéne tandis que *Pedicularia*, symbionte obligatoire de Stylasteridae, est connu dans le Messinien (Miocéne supérieur) et dans le Pléistocéne inférieur. Les faunes tertiaires comprennent, en plus de genres encore présents dans l'Atlantique nord-oriental, des genres qui font partie de la faune actuelle de l'Atlantique occidental et de l'Indo-Pacifique. *Errina aspera* (accompagnée de *Pedicularia*) vient d'être découvert dans le Plio-Pléiostocéne de Sicile et de Calabre, dans des conditions sédimentaires analogues á celles de son milieu actuel (détroit de Messina). Cette découverte tardive dans un secteur en principe bien prospecté depuis plus d'un siécle, confirme le peu d'attention porté aux Stylasteridae par les paléontologistes.

Source . MNHN, Paris

INTRODUCTION

The stylasterids, along with the milleporids and scleractinians, are classed as "hard" or "stony" corals, an obviously polyphyletic assemblage including various taxa in two of the three classes of cnidarians. Stylasterids were originally considered as scleractinians and it was only by 1873 that G.O. SARS began to question this relationship. Finally, during the "*Challenger*" expedition (1873-1876) one of the naturalists aboard, H.N. MOSELEY, discovered that stylasterids were highly modified hydroids and thus only distantly related to the anthozoan scleractinians. His results, based on observation of live material carried out during the circumnavigation, were published in a series of preliminary and very elaborate papers (MOSELEY, 1876b, 1877, 1879, 1881).

A check list of all stylasterid taxa then known (CAIRNS, 1983b) included 23 genera, 1 subgenus, 184 valid species (20 of them fossil), 11 formae or facies, 42 junior synonyms, 4 nomina nuda, and 4 unnamed "species". Subsequently the number of described species has increased by 35 (CAIRNS, 1985, 1986a, 1986b, 1987, 1988). Furthermore, we are aware of several new genera and many new species yet to be described in rich collections from South Africa, the southwestern Indian Ocean, New Caledonia, and New Zealand. Notwithstanding this expected further increase in number of described taxa, species of stylasterid corals will always remain far less numerous than species of scleractinian corals.

Correspondingly, the literature is less abundant on stylasterids than on scleractinians, and the list of major authors is considerably shorter for stylasterids. Extensive bibliographies compiled by BOSCHMA (1957a) and by VERVOORT & ZIBROWIUS (1981) document the previous literature.

This revision treats mainly the stylasterid fauna of the northeastern Atlantic and the Mediterranean. In the northeastern Atlantic (comprising to the east the coasts of Europe and Africa, and to the west Iceland, the Azores, seamounts southwest and south of the Azores, the Mid-Atlantic Ridge south to 23°31'N, and the Cape Verde Islands) we recognized 19 species, one of which is represented by 3 subspecies. Of all these taxa, 18 are fully described herein, whereas 3 that are known only from poor material are not named. Only one of these Atlantic species also occurs in the southwestern Mediterranean. For comparison, from about the same area, ZIBROWIUS (1980) studied 85 species of scleractinians (which did not represent the entire fauna known at that date); and out of these the Mediterranean scleractinian fauna comprises about 30 species.

In this paper we also include 2 species from the islands of the Gulf of Guinea, equatorial eastern Atlantic (Principe, São Tomé). These species are separated by approximately 15° of latitude from the nearest recorded stylasterids in the Cape Verde Islands, and by approximately 34° of latitude from the more diversified South African stylasterid fauna. Both species from the Gulf of Guinea occur in shallow water whereas only deep-water species exist in the Mediterranean and the northeastern Atlantic (shallowest records from about 100 m depth).

ABBREVIATIONS

The following abbreviations are used in the text

— for institutions:

AMNH	American Museum of Natural History, New York
BMNH	The Natural History Museum, London; formerly: British Museum (Natural History)
IMFB	Institut für Meeresforschung, Nordseemuseum, Bremerhaven
IRSNB	Institut Royal des Sciences Naturelles de Belgique, Bruxelles
MCM	Museu Carlos Machado, Ponta Delgada, Azores
MCZ	Museum of Comparative Zoology, Cambridge, Mass.
MHNG	Muséum d'Histoire Naturelle, Genève
MNHN	Muséum national d'Histoire naturelle, Paris
MZUC	Museo Zoologico, Università di Catania
MZUS	Musée Zoologique, Université de Strasbourg
NHMW	Naturhistorisches Museum, Wien
RMNH	Nationaal Natuurhistorisch Museum, Leiden; formerly: Rijksmuseum van Natuurlijke Historie
RSM	Royal Scottish Museum, Edinburgh
SMF	Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt a.M.
SMNH	Naturhistoriska Riksmuseet, Stockholm
UMZC	University Museum of Zoology, Cambridge, U.K.
USNM	National Museum of Natural History, Smithsonian Institution, Washington, D.C.
VSM	Det Kgl. Norske Videnskabers Selskab Museet, Trondheim
YPM	Yale Peabody Museum, New Haven, Conn.
ZMA	Zoologisch Museum, Amsterdam
ZMB	Museum für Naturkunde, Berlin
ZMUK	Zoologisk Museum, Københavns Universitet
ZMUO	Zoologisk Museum, Universitet i Oslo
ZSM	Zoologische Staatssammlung, München

— for stylasterid morphology:

H:W	height to maximum width ratio of gastrostyles

MATERIAL USED FOR THE REVISION

Many samples of stylasterids from various localities throughout the study area were available for this revision. These included types and other samples referred to in the literature, previously unpublished samples in museum collections, abundant new material primarily from French oceanographic cruises since 1958, and a few samples received from individual collectors. For complementary information see also Acknowledgements and List of deep-water stations from oceanographic cruises.

We thus studied stylasterids obtained by various oceanographic expeditions corresponding to more than a century of exploration in the northeastern Atlantic, starting with the " *Challenger* " circumnavigation in 1873. Material collected by submersibles is also included (" *Pisces III* " on Rockall Bank; " *Nautile* " cruise HYDROSNAKE on the Mid-Atlantic Ridge). The most diversified collections, in term of number of species, are those from the " *Talisman* " expedition in 1883, from the Prince of Monaco expeditions (1888 to 1905), and from the " *Jean Charcot* " cruise BIAÇORES in 1971. While the greater part of the " *Talisman* " stylasterids had been published already (but was in great need of a revision), those of the Prince of Monaco expeditions had remained unpublished, except for three mistakenly identified as bryozoans.

Stylasterids from the northeastern Atlantic and the Mediterranean are best represented in museums of Europe, but we also found several samples in American museums. A list of the institutions (with abbreviations used in the text) housing material studied herein is provided above.

One of us (H.Z.) had access (at the RMNH, in 1978 and 1980) to the abundant collections amassed by the late H. BOSCHMA before they were returned to the respective institution of origin. Among these collections originally loaned to BOSCHMA was abundant material from Norway belonging to the ZMUO and VSM, and various samples from the Faroes to Greenland (mainly from the " *Ingolf* " and " *Dana* " expeditions) belonging to the ZMUK.

Other institutions that provided many important samples for our revision were the BMNH, possessing many old samples including types; the MOM, possessing the samples from the Prince of Monaco expeditions; and the MNHN, possessing the greater part of the " *Talisman* " stylasterids and various other old samples including types. Surprisingly, there is only one lot of stylasterid from the " *Travailleur* " expeditions. In addition, the MNHM now houses the abundant material from the French oceanographic cruises in the Atlantic between 1958 and 1988 (some duplicates were given to other institutions) and various samples originally given to H.Z.

ACKNOWLEDGEMENTS

Assistance from many people in the institutions listed above (see Abbreviations) is gratefully acknowledged, their help including guidance in the collections, loan of specimens, and checking various data. Special thanks are extended to W. VERVOORT (retired director, RMNH), G. BEHRMANN (IMFB), C. CARPINE (MOM), P.F.S. CORNELIUS (BMNH), D. KÜHLMANN (ZMB), and M.E. CHRISTIANSEN (ZMUO).

Part of the "*Thalassa*", "*Cryos*" (cruise BALGIM), and "*Noroit*" (cruise SEAMOUNT 1) stylasterids, and the "*Nautile*" (cruise HYDROSNAKE) stylasterids were kindly provided by M. SEGONZAC (Centre de Tri d'Océanographie Biologique, Brest). We further want to thank S. GOFAS and J. LABOREL for specimens collected by diving in the Gulf of Guinea; L. SALDANHA for transmitting samples from the Gulf of Guinea and from off the Azores; J. STIRN for material from Morocco; A. FREIWALD for material from Denmark Strait; J.B. WILSON for material from Rockall and Anton Dohrn Seamount; T.P. SCOFFIN for material from Porcupine Bank; C. ALVAREZ-CLAUDIO for material from the south of the Bay of Biscay; G. BELLAN for material from Hyères Seamount; P. COLANTONI, I. DI GERONIMO and G. FREDJ for specimens from the Straits of Messina and corresponding information; P. BARRIER for the rich fossil stylasterid fauna from Carboneras, southeastern Spain; F. KÉZIRIAN for fossil stylasterids and *Pedicularia* from Sicily; G. HARTMANN-SCHRÖDER for identification of symbiotic polychaetes; and P.M. ARNAUD for information on the symbiotic gastropod genus *Pedicularia*.

H.Z. also acknowledges the opportunity of taking part in cruises that permitted the collection of stylasterids: "*Jean Charcot*" cruise BIAÇORES in 1971 (chief scientist J. FOREST), "*Thalassa*" in 1972 and 1973 (chief scientist L. CABIOCH), "*Cryos*" cruise BALGIM in 1984 and "*Noroit*" cruise SEAMOUNT 1 in 1987 (chief scientist P. BOUCHET).

The scanning electron micrographs were taken by S.D.C. in the S.E.M. Laboratory of the National Museum of Natural History, Smithsonian Institution.

HISTORICAL REVIEW

The first stylasterid species to be described from the study area was *Errina aspera* (Linnaeus, 1767), from the Mediterranean (also reported, by error, from Norway). Next reported were *Stylaster norvegicus* (Gunnerus, 1768) from Norway, and *Stylaster gemmascens* (Esper, 1794), most likely also from Norway although its origin was given as the Indian Ocean.

Allopora oculina Ehrenberg, 1834, was reported from an unknown origin, but most likely was *Stylaster norvegicus* from Norway; the name *A. oculina* was later used again by Norwegian authors for *S. norvegicus*.

In their series of " monographies " and " histoire naturelle des coralliaires ", in which MILNE EDWARDS & HAIME (1848-1860) gave a rather complete inventory of the scleractinians then known from the Mediterranean and the northeastern Atlantic, they were less successful with the stylasterids, which at that time were still included in the scleractinian family Oculinidae. From their own experience the authors knew *Stylaster gemmascens* and *Allopora oculina* (probably identical with *Stylaster norvegicus*) and described these in some detail, but they mentioned *Stylaster norvegicus* (under *Allopora norvegica*) as a doubtful species and overlooked *Errina aspera* (MILNE EDWARDS & HAIME, 1850, 1857).

Stenohelia maderensis (Johnson, 1862), originally described from Madeira, was later reported also from the Cape Verde Islands (SAVILLE KENT, 1872; GREEFF, 1884).

Next to be reported, from the Faroes – Hebrides area (DUNCAN, 1870, 1873), was *Pliobothrus symmetricus* Pourtalès, 1868, a species originally described from the western Atlantic.

Errina dabneyi (Pourtalès, 1871) was the first species to be described from the Azores, an area from which the stylasterid fauna subsequently was found to be more diversified than in the other areas investigated.

Crypthelia pudica Milne Edwards & Haime, 1849, originally described from the Philippines, was mistakenly reported by MOSELEY (1879, 1881) from south of the Canary Islands (" *Challenger* " expedition), and by FILHOL (1885) without indication of the locality from the " *Talisman* " expedition. In fact, the " *Challenger* " stylasterid was *Crypthelia affinis* Moseley, 1879, which had been figured and confusedly named (but not described) under that name, whereas the " *Talisman* " stylasterid was most likely *Crypthelia tenuiseptata* Cairns, 1986.

Of the two species reported by GREEFF (1884) from the islands of the Gulf of Guinea, one was described as new, *Stylaster rosaceus* (Greeff, 1884), whereas the other was misidentified as the South African *Stylaster subviolaceus* (Saville Kent, 1871) and was much later recognized as a distinct species, *Stylaster blatteus* (Boschma, 1961).

Another exotic species mistakenly reported by THORNELY (1897) was the southeastern Pacific *Stylaster sanguineus* Milne Edwards & Haime, 1850, which is, in fact, *Stylaster gemmascens* (Esper, 1794) from Rockall Bank.

Lepidopora eburnea (Calvet, 1903) from the Azores was originally described as a bryozoan of the genus *Hornera* (independently described as *Lepidopora hicksoni* Boschma, 1963). In addition, CALVET (1903, 1911) redescribed *Errina dabneyi* and *Pliobothrus symmetricus* (see above) as bryozoans: *Hornera verrucosa* and *Hornera gravieri*, respectively. Two more stylasterid species (*Crypthelia*) have now been discovered in the Prince of Monaco collection, which heretofore had not been the subject of a synthesis.

Errina atlantica Hickson, 1912, was described long after the material had been collected by the " *Talisman* " expedition in 1883. In the same paper (HICKSON, 1912b) the Philippine *Stenohelia tiliata* Hickson & England, 1905, was mistakenly reported from the Cape Verde Islands (a confusion with *S. maderensis*) and the western Atlantic *Pliobothrus tubulatus* (Pourtalès, 1867) mistakenly reported from the Azores (a confusion with *Lepidopora eburnea*). Altogether HICKSON's (1912b) report on (part of) the stylasterids of the " *Talisman* " expedition included 6 species (2 of them misidentified) from the Cape Verde Islands and the Azores.

BROCH's (1914a) report on the stylasterids from the " *Ingolf* " expedition was more exemplary and included 4 species (one misidentified) from high latitudes. He mistakenly reported the West Indian *Stylaster roseus* (Pallas, 1766) from the Greenland – Iceland area; this identification was corrected by BOSCHMA (1955b, 1965c) as *Stylaster erubescens* Pourtalès, 1868, the latter species being previously known only from the western Atlantic. In this paper the North Atlantic *S. erubescens* sensu BOSCHMA is considered as a distinct subspecies, *S. erubescens groenlandicus* n. ssp., differing from the nominotypical West Atlantic *S. erubescens erubescens* (the latter redescribed by CAIRNS, 1986a).

Starting in 1951, BOSCHMA published original data on a greater number of stylasterid species worldwide than any other author before (see VERVOORT & ZIBROWIUS, 1981), including on species from the Mediterranean, the northeastern Atlantic, and the Gulf of Guinea. The analysis of a register and the collections (comprising material sent to him on loan from various museums) found at the RMNH after BOSCHMA's death shows that he had access to 12 out of the 23 species and subspecies revised here. Unfortunately BOSCHMA's observations had not been the subject of a synthesis and his published results on this fauna are dispersed throughout many smaller notes.

In the original description of *Crypthelia tenuiseptata* Cairns, 1986, which was based on western Atlantic material, the distribution was given as amphiatlantic, including the Azores, Hyères Seamount, and Madeira. This indication is here corrected: in the eastern Atlantic *C. tenuiseptata* is known only from the Azores, whereas the *Crypthelia* from Hyères Seamount and Madeira is *C. vascomarquesi* n. sp. (it also occurs in the Azores). The other new species and subspecies described here are *Pliobothrus gracilis* n. sp. from Hyères Seamount, *Stylaster maroccanus* n. sp. from off the Atlantic coast of Morocco, *Stylaster ibericus* n. sp. from off northwest Spain, *Stylaster erubescens groenlandicus* n. ssp. from south and east of Greenland to northwest and southeast of Iceland, *S. erubescens britannicus* n. ssp. from southeast of Iceland to the Celtic Sea, *S. erubescens meteorensis* n. ssp. from the Great Meteor Seamount and southwest of the Azores (imprecise locality), and *Crypthelia medioatlantica* n. sp. from the Azores and the Mid-Atlantic Ridge south of the Azores.

In addition, a flattened form of *Lepidopora* from the Canary Islands collected by the " *Challenger* " in 1873 (previously unpublished and considered as *Lepidopora* sp. B herein) definitely is a distinct species, whereas a clavate form of *Lepidopora* from off Mauritania collected by the " *Talisman* " in 1883 (previously identified as *L. eburnea* and considered as *Lepidopora* sp. A herein), remains problematical, but has at least a look distinct of closely related typical *L. eburnea*. There is also a *Stenohelia* from the Azores, unfortunately represented only by a small colony, which differs from *S. maderensis* (considered as *Stenohelia* sp. A herein).

Although most of the 23 species and subspecies studied here had already been collected before the end of the 19th century (3 of which had even been named as early as in the 18th century), the present revision is the first attempt of a representative faunistic study for this area.

BIOGEOGRAPHY

In our analysis of the distribution patterns and affinities of the northeastern Atlantic and Mediterranean stylasterid fauna, the Scleractinia are used as the reference group. These other " hard " or " stony " corals are well known in the investigated area (ZIBROWIUS, 1980) where they are represented by considerably more species than the stylasterids.

The northern limit in the Atlantic of stylasterids (*Stylaster norvegicus, S. gemmascens, S. erubescens*) roughly coincides with that of the scleractinians. Both groups attain northern Norway, the Faroes, Iceland, and southern Greenland (Denmark Strait), but are absent from the Arctic basin. This is in contrast to the presence of numerous species of both groups in Antarctic waters (CAIRNS, 1982, 1983a) where conditions favorable to benthic life were not largely disrupted during the Pleistocene.

The Mediterranean has only one stylasterid species (*Errina aspera*), which equates to a mucb lower proportion of the Atlantic species than the approximately 30 species of scleractinians in common to the Mediterranean and the northeastern Atlantic. However, the greater part of the scleractinian species living in the Mediterranean occur in shallow water, whereas the stylasterids from corresponding latitudes in the Atlantic are deep-water species. In terms of number, the shallow-water scleractinians are more successful in the present Mediterranean than the deep-water species, but the latter were more diversified during the Pleistocene when the Mediterranean deep hydrology was more similar to that of the present northeastern Atlantic (ZIBROWIUS, 1980; BARRIER *et al.*, 1989). The deep-water stylasterids may also have been more successful in the Pleistocene Mediterranean, but thus far the fossil records are missing.

Errina aspera is the only stylasterid species living in the Mediterranean, where it appears to be limited to the southwestern part (including the Straits of Messina); it thereby shows a common distribution pattern with some scleractinians.

Concerning rarely collected stylasterids, it may still be premature to compare distribution patterns. Nevertheless, some trends appear sufficiently evident from the available data.

Few of the 23 stylasterid species and subspecies recorded from the northeastern and equatorial eastern Atlantic have a wide latitudinal range, the exceptions (group 1) being: *Stenohelia maderensis* from the Cape Verde Islands through Madeira, Galicia Seamount, and the Bay of Biscay to the Faroes Channel (range 45° of latitude; the northernmost occurrence needing confirmation by new records); *Stylaster erubescens* with three subspecies from Great Meteor Seamount through the Celtic Sea and the Faroes to Iceland and Greenland, Denmark Strait (range 36° of latitude); *Pliobothrus symmetricus* from Madeira and the Azores through the Celtic Sea and the Faroes to southwest of Iceland (range 31° of latitude); *Errina aspera* from the Cape Verde Islands through the Straits of Gibraltar to the Straits of Messina (range 23° of latitude); and *Lepidopora* sp. A from Mauritania through Morocco to Galicia Seamount (range 23° of latitude).

Although they are proportionally rather widespread (compared with group 3 below), some other species (group 2) appear to have a considerably narrower range in latitude. *Stylaster norvegicus* and *S. gemmascens* are known to occur only in high latitudes, from Norway to Iceland and Greenland, respectively, but apparently do not extend south beyond Rockall Bank (at about 58°N). *Crypthelia vascomarquesi* is known from three distant areas (Hyères Seamount, Azores, Madeira Archipelago) that are not widely separated in latitude (range only 7°); this species is perhaps more

widely destributed north and south of Madeira (poorly known representatives of *Crypthelia* from Selvagens Archipelago and Josephine Seamount).

Available data suggest that the remaining species (group 3) occur in a more limited area. Several species are thus far known from the Azores and in part from the Mid-Atlantic ridge to the southwest: *Lepidopora eburnea, Errina dabneyi, E. atlantica, Stenohelia* sp. A, *Crypthelia affinis, C. medioatlantica,* and *C. tenuiseptata.* Pending additional records and further investigations, forms similar to *Lepidopora eburnea* and *Errina atlantica* from seamounts between Portugal and Madeira are not formally referred to the Azorean species. *Crypthelia affinis* is provisionally included here; in fact its type locality (given as far southwest of the Canary Islands with the unusual depth of 2790 m) may be incorrect and thus the species is positively known only from the Azores. *Pliobothrus gracilis* was obtained only from Hyères Seamount, *Lepidopora* sp. B from one station off the Canary Islands, *Stylaster maroccanus* only once off Morocco, and *S. ibericus* exclusively northwest of Spain.

Tbe shallow-water species *Stylaster rosaceus* and *S. blatteus* from the islands of the Gulf of Guinea have not been found elsewhere.

With 9 species (*Lepidopora eburnea, Pliobothrus symmetricus, Errina dabneyi, E. atlantica, Stenohelia maderensis, Crypthelia affinis, C. medioatlantica, C. vascomarquesi, C. tenuiseptata*), the fauna of the Azores is the most diversified. For comparison, the stylasterid faunas of the Cape Verde Islands, the Canary Islands, and the Madeira Archipelago appear poor with one to three species thus far recorded. The situation is similar concerning the deep-water scleractinian fauna of these archipelagos (ZIBROWIUS, 1980). In part this impression may be due to a more intense investigation of the Azores, notably by the " *Talisman* ", the Prince of Monaco expeditions, and " *Jean Charcot* " cruise BIAÇORES.

Three of the 21 stylasterid species (15 %) recorded from the northeastern and equatorial eastern Atlantic also occur in the western Atlantic (CAIRNS, 1986a). Among these, *Pliobothrus symmetricus* and *Stylaster erubescens* (with distinct subspecies) range from the West Indies to the eastern margin of the Atlantic and attain high latitudes, whereas *Crypthelia tenuiseptata* is known only from the West Indies and the Azores. None of the specifically northeastern Atlantic stylasterids is known from any other area. Furthermore, there are no species in common with the South African fauna or that of the Indo-Pacific. Proportionally more deep-water scleractinians have amphiatlantic distributions (CAIRNS, 1979; ZIBROWIUS, 1980), and some species have even wider geographic ranges extending into the Indo-Pacific.

With 21 species in 6 genera, the stylasterid fauna of the northeastern Atlantic (to which are herein annexed the 2 species of the Gulf of Guinea) is considerably less diversified than the geographically nearest stylasterid fauna of the West Indies, which comprises 42 species in 8 genera (CAIRNS, 1986a). The genera *Lepidotheca* and *Distichopora* are not represented in the northeastern Atlantic. In the northwestern Atlantic no stylasterids are thus far recorded from between North Carolina and Greenland, whereas in the northeastern Atlantic no similar gap of recorded distribution exists.

The West Indian stylasterid fauna has only one shallow-water species (*Stylaster roseus*); likewise, shallow-water species occur in the eastern Atlantic in the Gulf of Guinea (*Stylaster rosaceus, S. blatteus*). However, shallow-water stylasterids are not confined to tropical areas; some do exist on the coast of South Africa and in the fjords of New Zealand. A preliminary study (H.Z.) of the South African stylasterid fauna, largely based on the collections of the South African Museum, Cape Town, shows that, in a smaller geographical area this fauna is about as diversified in term of number of species as the northeastern Atlantic stylasterid fauna.

SYMBIOTIC ASSOCIATIONS

Attention has been focused by ZIBROWIUS (1981) on the diversity of symbiotic associations involving stylasterid corals and other organisms. That preliminary inventory, which was worldwide and based on records from the literature and on new observations, listed the following symbionts adapted to life on a stylasterid host (simple epibionts on dead parts of skeleton excluded):

— a nemertean coiled around tops of branches and causing an unusual structure of the irritated zone;

— a species of *Polydora* (spionid polychaete) perforating living branches;

— a species of *Autolytus* (syllid polychaete) living in blister-like galls;

— various species of polynoid polychaetes causing gallery-like gall-tubes with lateral openings along stems and branches (a particular new case reported by CAIRNS, 1987);

— gastropods of the prosobranch genus *Pedicularia* having their shell contour adapted to the precise place where they settled on the coral branch;

— tiny pycnogonid larvae found inside gastrozooids (larger pycnogonid larvae inside the gastropore tube have been found subsequently by H.Z. on material from New Zealand);

— siphonostomatoid copepods which cause galls each of which envelop a cyclosystem;

— a thoracic cirriped largely overgrown by its host coral;

— an acrothoracic cirriped perforating live branches; and

— aplacophoran molluscs coiled around stylasterid branches or inside polynoid gall-tubes have recently been reported by CAIRNS (1986b, 1987).

When the northeastern Atlantic and Mediterranean stylasterid fauna was investigated in detail, symbiotic associations were especially noted and three types were found, one of them here reported for the first time.

1) *Eunice norvegica* (Linnaeus, 1767) (identified by G. HARTMANN-SCHRÖDER), an eunicid polychaete, lives in colonies of *Errina atlantica* from the Azores. The rather large worm (several cm long) builds its own tube of a soft organic material which, providing an additional substrate for the coral, is subsequently covered by the coenosteum. The worm tube thus influences the shape of the colony by inducing growth along a preferential axis. Covered by the coral skeleton, the tube becomes equivalent to a strong trunk of the colony (Fig. 14 A).

Previously, *Eunice norvegica* was known as a symbiont of three colonial deep-water scleractinian corals (ZIBROWIUS, 1980), all of which cover the worm tube as described above for the stylasterid: *Madrepora oculata* Linnaeus, 1758; *Lophelia pertusa* (Linnaeus, 1758); and *Solenosmilia variabilis* Duncan, 1873.

2) Although polynoid polychaetes are probably the most widely distributed type of stylasterid symbiont, they are poorly represented in the northeastern Atlantic stylasterids. Only one colony of *Stenohelia* sp. A from an unknown station in the Azores shows an irregular growth caused by the presence of a gall-tube inhabited by *Harmothoe* sp. (identified by G. HARTMANN-SCHRÖDER; Fig. 35 G). The infested colony is not flabellate as normal *Stenohelia* colonies. For comparison, in the western Atlantic several species of stylasterids have a polynoid symbiont (CAIRNS, 1986a). In the case of the polynoid − stylasterid association, the polychaete does not produce its own tube of organic material which is subsequently covered by the coral. Instead, the gall-tube is entirely an induced production of the coral.

3) The prosobranch gastropod *Pedicularia* causes a characteristic, very localized modification of the stylasterid branch surface. It deposits a layer of lime under which the sealed off skeleton cannot grow in thickness, unlike the surrounding skeletal areas. This may result in a slight depression, the contour of which fits that of the shell. Generally the crust of lime deposited by the snail (apparently by its foot) comprises conspicuous prominent crests which considerably enlarge the crust surface and on which the foot of the snail adheres more efficiently. These elongate subelliptical or more irregular *Pedicularia* traces (Fig. 1 C, 2 C, 5 C, 9 G, 11 H, 14 B, 25 A, D, E, 33 C) are easily recognizable and provide information on the occurrence of the snail, even when the latter had been lost, or when the stylasterid was already dead when collected.

Pedicularia gastropods are the most common symbionts of the northeastern Atlantic and Mediterranean stylasterids. Their characteristic traces, if not the molluscs themselves, have been found on 8 species and subspecies: *Lepidopora eburnea, Pliobothrus symmetricus, Errina aspera, E. dabneyi, E. atlantica, Stylaster ibericus, S. erubescens britannicus*, and *Stenohelia maderensis*. In the investigated area the *Pedicularia* – stylasterid association has thus been recognized in the Azores, Madeira Archipelago, Canary Islands (only isolated disassociated *Pedicularia* collected here), Cape Verde Islands, Celtic Sea, off northwestern Spain, Atlantic coast of Morocco, Straits of Gibraltar, and Straits of Messina. Indirect records of *Pedicularia* (traces on *Pliobothrus symmetricus* and *Stylaster erubescens britannicus*) from the Celtic Sea at 48°37.0′N to 48°38.2′N are the northernmost ones known worldwide.

Pedicularia from the northeastern Atlantic area have been reported in the malacological literature (Bellon-Humbert & Gofas, 1977; Dautzenberg, 1889, 1927; Locard, 1897; etc.) under various specific names: *P. sicula* Swainson, 1840; *P. decussata* Gould, 1855; *P. decurvata* Locard, 1897; and *P. sicula* var. *sublaevigata* Locard, 1897. Bouchet & Waren (1992) synonymize all these under *P. sicula*.

The incidence of *Pedicularia* on the northeastern Atlantic and Mediterranean stylasterid fauna is considerably higher than on that of the western Atlantic. In the western Atlantic, *Pedicularia* traces are rare (not mentioned by Cairns, 1986a) and are known only from 4 species: *Stylaster complanatus* Pourtalès, 1867, from Cuba near Havana; *Stylaster erubescens* Pourtalès, 1867, from the Blake Plateau; *Conopora* sp. from northwestern Brazil; and *Crypthelia peircei* Pourtalès, 1867, from Guadeloupe and St. Vincent. Apparently no specimen of western Atlantic *Pedicularia* has yet been seen on its host coral.

RECORDS OF FOSSIL STYLASTERIDS FROM EUROPE

Records of fossil stylasterids are worldwide but comparatively rare. In emerged areas neighbouring the Mediterranean and the northeastern Atlantic, fossil stylasterids are thus far known only from Europe.

The geologically oldest record, from the Maastrichtian (uppermost Cretaceous) of Denmark, is only briefly mentioned by FLORIS (1979) in a paper dealing mainly with scleractinians. Alluding to previous records from the Danian (lowermost Paleocene, see below), FLORIS indicated that " rare finds of stylasterine have now also been made in the Maastrichtian "; however, these stylasterids from the Maastrichtian are not even tentatively referred to genera.

NIELSEN (1919) distinguished 8 new species from the Danian of Fakse (= Faxe), Denmark, originally considered as uppermost Cretaceous but now known to be Lower Paleocene: *Sporadopora faxensis, Pliobothrus dispergens, P. laevis, Spinipora irregularis, Labiopora lobata, Congregopora nasiformis, Astylus crassus*, and *Conopora arborescens*. BOSCHMA (1951a) reproduced the description and figures of *Congregopora nasiformis* and discussed the affinities of this form. NIELSEN's 8 species, with subsequent citations by other authors (no original new data) are listed by BOSCHMA (1957a), who also transferred 3 of them into different genera: *Spinipora irregularis* and *Labiopora lobata* into the genus *Errina*, *Astylus crassus* into the genus *Astya*. CAIRNS (1983b) followed BOSCHMA, except for transferring *Labiopora lobata* into the genus *Errinopora* (not *Errina*) and considered most species (except *Errina irregularis*, formerly under *Spinipora*) as of uncertain generic placement, or *incertae sedis*. Some of NIELSEN's species have been reported again from Fakse by BERNECKER & WEIDLICH (1990).

Distichopora antiqua Defrance, 1826, from the Eocene of the Paris basin (list of references in BOSCHMA, 1957a) is a typical representative of the genus *Distichopora* (specimen at MNHN labelled " calcaire grossier de Chaumont ").

Allopora compressa (Römer, 1863), as revised by BOSCHMA (1951b) (detailed synonymy also in BOSCHMA, 1957a), has been described from the Oligocene of Lattorf near Kassel, Germany, under various names: *Dendracis compressa* Römer, 1863; *D. multipora* Römer, 1863; *D. pygmaea* Römer, 1863; *D. tuberculata* Römer, 1863; and *Cryptaxis alloporoides* Reuss, 1865. CAIRNS (1983b) included this species in *Stylaster* (Group A).

Stylaster priscus Reuss, 1872, has been described and figured in some detail from material from the Miocene of Porzteich near Nikolsburg (now Mikulov), Moravia, Central Czecho-Slovakia. BOSCHMA (1951b, 1957a) listed it as *Allopora prisca*. CAIRNS (1983b) included this species in *Stylaster* (Group B).

Stylaster antiquus Michelotti in Sismonda, 1871, was summarily described (not figured) from material from Sassello near Savona, Liguria, northwestern Italy Originally referred to the Lower Miocene, it has later been considered as from the Oligocene. This species was also mentioned by DE ANGELIS (1895) and BOSCHMA (1951a, 1957a). CAIRNS (1983b) included this species in *Stylaster* (Group C).

GIGNOUX (1913: 650) mentioned *Distichopora* sp. from what he considered as upper Pliocene (now identified as Lower Pleistocene) at Musalà near Villa San Giovanni, Calabria, southern Italy. MIRIGLIANO (1949) also mentioned *Distichopora* sp. in the species list of a Plio-Pleistocene fauna from the province of Salerno, southern Italy. No further information was provided, and the corresponding

material could not be located at Naples (university and museum) where MIRIGLIANO carried out his study (I. DI GERONIMO, *in litt.* 1979).

Heretofore unreported fossil stylasterids include the following new geographic records from the Mediterranean basin.

A remarkably rich fauna (in fact the most diversified assemblage of fossil stylasterids presently known) was discovered in 1989 by P. BARRIER in the " red brecchia " of Messinian age (Upper Miocene) at Carboneras, southeastern Spain (BARRIER *et al.*, 1992). It comprises at least 14 species in at least 8 genera: *Calyptopora, Conopora, Crypthelia, Distichopora, Lepidopora, Pliobothrus, Stenohelia, Stylaster* (Groups A, C, sensu CAIRNS, 1983b). In addition, one shell of the gastropod *Pedicularia*, an obligate symbiont of stylasterids, was found with that fauna; this is the oldest record of *Pedicularia* known.

Ironically, *Errina aspera*, the only stylasterid species now living in the Mediterranean and occurring abundantly in the Straits of Messina, had previously not been reported as a fossil from this area rich in Plio-Pleistocene fossiliferous deposits. According to MONTENAT & BARRIER (1985) and BARRIER, DI GERONIMO & MONTENAT (1988), a narrow passageway similar to the present Straits of Messina in canalizing strong tidal currents, already existed in the Plio-Pleistocene. Most likely, ideal conditions for *E. aspera* occurred there in the past as they do at present.

Although *E. aspera* was heretofore missing from the faunal lists of the Plio-Pleistocene, the obligate symbiont of stylasterids, *Pedicularia*, was already known as a fossil from Sicily: SEGUENZA (1865) described *P. deshayesiana* from what he considered as Miocene (in fact, Plio-Pleistocene) of Rometta near Messina. A few years ago, a second fossil specimen of *Pedicularia* was obtained by I. DI GERONIMO (pers. comm.) from the Lower Pleistocene near Capo dell'Armi, Calabria (locality Canale).

Specially searched for, *E. aspera* has finally been obtained (in 1990; most specimens by F. KÉZIRIAN) on both sides of the Straits of Messina: in Calabria from the Lower Pleistocene near Capo dell'Armi (same locality Canale as for *Pedicularia*; see above); in Sicily (province of Messina) from the Upper Pliocene at Salice, and from the Lower Pleistocene at Giampilieri and at Casino di Falcone (together with *Pedicularia*). In addition, when studying fossil scleractinians (H.Z.) from Sicily described by SEGUENZA (1864) and donated by him to the Wien museum, one small colony of *E. aspera* was recently discovered attached to a fragment of *Lophelia defrancei* sensu SEGUENZA (NHMW 1864/XXI/242). This sample, with SEGUENZA's original label indicating " dintorni di Messina ", should be considered as of imprecise origin (Messina area) and of Plio-Pleistocene age although a later museum label refers it to SEGUENZA's " Miocene " of St. Filippo near Messina.

The Lower Pleistocene deposit at Casino di Falcone (Sicily; see above) also contains a second species of stylasterid of which only a tiny fragment is presently known: it is a typical *Stenohelia*, probably referable to *S. maderensis*, a species still living in the north-eastern Atlantic.

The records of fossil stylasterids from Europe are too scarce to permit an analysis of how the stylasterid fauna of European seas evolved since the late Cretaceous. The generic attribution of most of the Lower Paleocene stylasterids from Denmark remains questionable due to incomplete conservation of essential structures. Two of the genera possibly represented in the Fakse fauna do still exist in European seas: *Pliobothrus* and *Errina*. A few representatives of the large genus *Stylaster* (Groups A, B, C, sensu CAIRNS, 1983b) are well documented in the Oligocene and Miocene of central Germany, Central Czecho-Slovakia (Moravia), northwestern Italy, and southeastern Spain. Related forms of *Stylaster* (Groups A, B) still live in European seas.

In addition to genera still represented in Europeans seas (*Crypthelia, Lepidopora, Pliobothrus, Stenohelia, Stylaster*), the rich Messinian fauna of Carboneras comprises genera that no longer occur there. *Calyptopora* is known only in the Indo-Pacific and *Conopora* is widespread throughout the Indo-Pacific and in Antarctic and Sub-Antarctic waters, the nearest location to Europe being off Brazil.

The genus *Distichopora* deserves special attention. In the Indo-Pacific it is now represented by several shallow- and deep-water species (BOSCHMA, 1959), and in the western Atlantic (Caribbean) by several deep-water species (CAIRNS, 1986a). It is absent from the northeastern Atlantic and

adjacent waters. The Eocene *D. antiqua* from the Paris basin and the unnamed *Distichopora* from the Messinian of Carboneras are authentic *Distichopora*, whereas we may doubt the correct generic identification of GIGNOUX's (1913) and MIRIGLIANO's (1949) *Distichopora* sp. from the Plio-Pleistocene of southern Italy (specimens unavailable). Although *Distichopora* is easily recognizable among all other stylasterids, GIGNOUX and MIRIGLIANO were surely not experts on this group. A confusion with morphologically convergent bryozoan colonies is most probable, especially since " transphyletic " confusions have happened to trained bryozoan and coral workers (see ZIBROWIUS, 1982, and CAIRNS, 1983b: 441, for examples).

TAXONOMICAL REVISION

The 21 species included in this revision belong to 6 genera. Because CAIRNS (1983b) has already published a generic revision, general information on these genera is kept to minimum.

The presentation of each species (and subspecies) entails the following arrangement: valid name followed by author and date, synonymy and chresonymy (see SMITH & SMITH, 1972), types, material studied, description, comparisons, remarks, distribution and ecology, and symbionts. Under " types ", information is provided on all nominal species subsequently synonymized. Under " material studied " only cursory data are given for deep-water stations from oceanographic expeditions; detailed station data for all expeditions are compiled in a general station list. The passage " remarks " includes historical comments (see also under types) and rectification of misidentifications in the previous literature.

The morphological terminology used in the descriptions is that reviewed, augmented and illustrated by CAIRNS (1983b, 1985, 1986a, 1986b); however an additional new term is introduced here. A binary ampulla is a large female ampulla, usually elongate in shape, with two efferent pores on opposite vertices and, presumably, two planulae within (see *Stenohelia maderensis*).

Key to the genera of Stylasteridae from the study area

1a Gastro- and dactylopores not arranged in cyclosystems 2
1b Gastro- and dactylopores arranged in cyclosystems 4
2a Gastropore without gastrostyle ..... ***Pliobothrus***
2b Gastropore with gastrostyle 3
3a Dactylopores are (low) apically perforate cones ..... ***Lepidopora***
3b Dactylopores are U-shaped spines with slit ..... ***Errina***
4a Cyclosystem (partially) covered by lid;
gastropore tube double-chambered;
gastro- and dactylostyles absent ..... ***Crypthelia***
4b Cyclosystem without lid;
gastropore tube cylindrical;
gastro- and dactylostyles present 5
5a Cyclosystems unifacially arranged;
gastropore tube long and curved;
ampullae usually clustered near cyclosystems ..... ***Stenohelia***
5b Cyclosystems randomly or sympodially arranged;
gastropore tube (usually) short and (nearly) straight;
ampullae scattered randomly over coenosteum ..... ***Stylaster***

Genus *LEPIDOPORA* Pourtalès, 1871

Diagnosis. — Coordination of gastro- and dactylopores usually random; however, in some species dactylopores serially arranged on branch edges, and gastropores serially arranged on anterior or anterolateral branch faces. Coenosteal texture quite variable. Gastropores often bordered by proximal lip; gastro- and dactylopore tubes long. Gastrostyles usually not ridged; H:W ratio high. Dactylopores apically perforate mounds; no dactylostyles.

Type species: *Errina glabra* Pourtalès, 1867, from the western Atlantic.

Lepidopora was formerly considered as a subgenus of *Errina* Gray, 1835. *Lepidopora* is represented in the study area by one well known species from the Azores, *L. eburnea* (Calvet, 1903), and two unnamed forms. Under *Lepidopora* sp. A, we provisionally group problematical material (in part poorly preserved) close to *L. eburnea*, from Mauritania, Morocco, and Seine, Gorringe and Galicia Seamounts. In contrast, *Lepidopora* sp. B, known only from one well preserved but incomplete specimen from the Canary Islands, definitely is a distinct species.

Lepidopora eburnea (Calvet, 1903)

Fig. 1 A-F, 2 A-J

Synonymy:

Hornera eburnea Calvet, 1903: 162, pl. 18, fig. 5a-c.
Errina (*Lepidopora*) *hicksoni* Boschma, 1963a: 339-342, text-fig. 1, pl. 1, fig. 1-3.

Chresonymy:

Hornera eburnea — Calvet, 1906: 479 (part, not " *Talisman* " drag. 96, Mauritania); 1931: 45. — Borg, 1944: 203. — Belloc, 1960: 12.
Errina (*Lepidopora*) *eburnea* — Zibrowius, 1981: 982 (part, not " *Talisman* " drag. 96, Mauritania).
Errina (*Lepidopora*) *hicksoni* — Boschma, 1963b: 395-396; 1964a: 61; 1967: 335-336; 1968c: 207. — Vervoort & Zibrowius, 1981: 27.
Lepidopora hicksoni — Cairns, 1983b: 428.
Pliobothrus tubulatus — Hickson, 1912b: 465, pl. 8, upper fig.

Types

Hornera eburnea: In the original description, Calvet (1903) mentioned " a beautiful sample " from the Azores (Prince of Monaco stn 229), apparently the figured colony (40 mm high, 35 mm wide). Being the only specimen mentioned, it must be considered the holotype. Its depository is unknown. The MOM possesses 3 smaller topotypic specimens (stn 229) not specially mentioned by Calvet (lower part of 2 colonies and 1 slender distal branch; part of them figured herein, Fig. 1 D-E).

Type locality: Prince of Monaco stn 229, 16.8.1888, 38°22'N, 28°14'24"W, 736 m. Azores.

Errina (*Lepidopora*) *hicksoni*: In the original description, Boschma (1963a) designated the holotype and a paratype: as holotype the colony figured by Hickson (1912b, pl. 8, upper figure with the explanation " *Pliobothrus tubulatus*, Azores, 56 meters "), and as paratype a colony figured in his own paper (pl. 1, fig. 3), also part of the material previously referred to *P. tubulatus*. The holotype was known to Boschma only from Hickson's paper and was presumed to be deposited at the MNHN; in fact, this specimen had been retained by Hickson and later transferred to the BMNH (1964.9.17.11). The specimen designated paratype had also been retained by Hickson and deposited at the Manchester museum (from where Boschma had it on loan and to where he returned it in 1969,

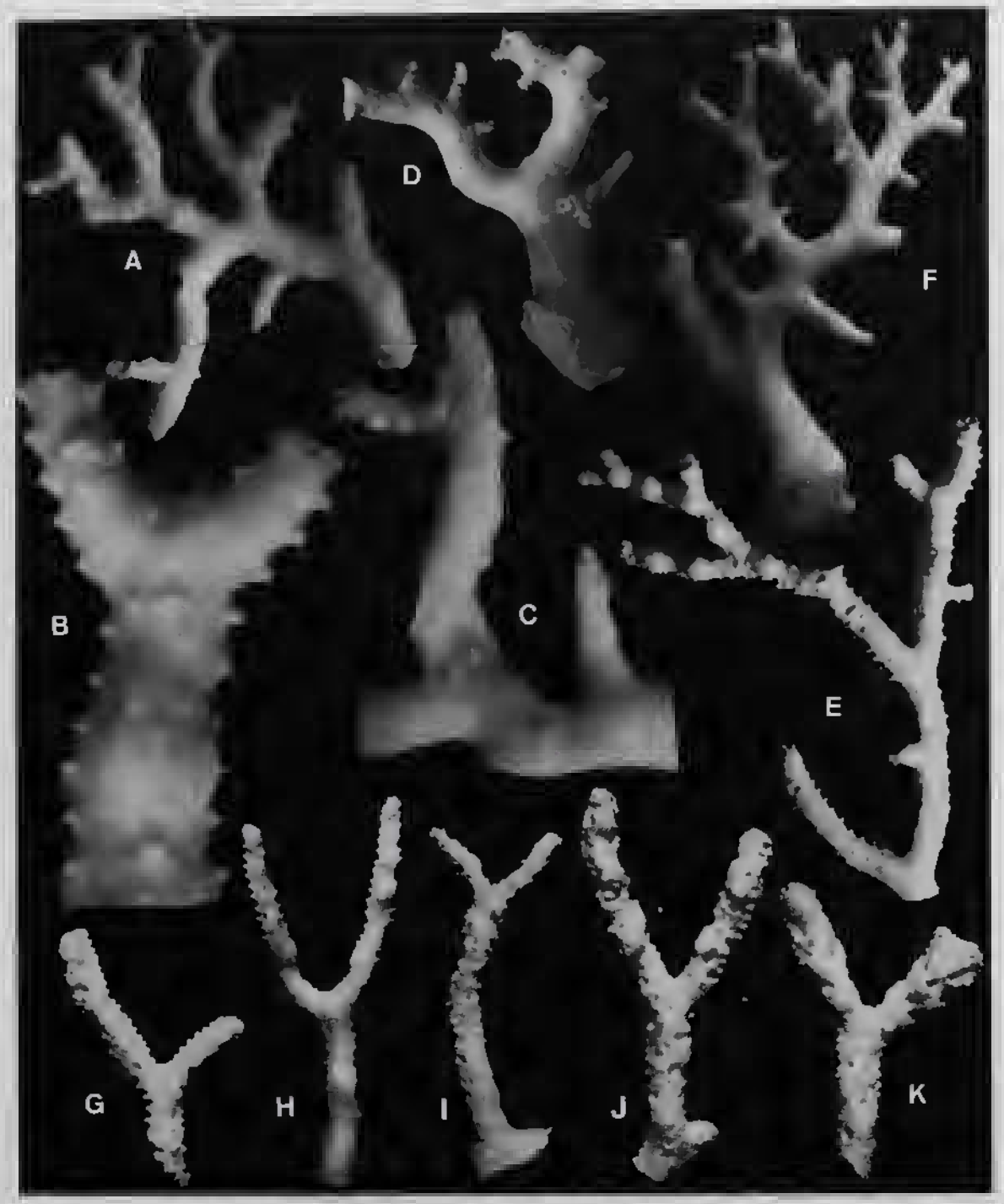

FIG. 1. — *Lepidopora eburnea* (A-C, from " *Talisman* " drag. 123, MNHN; D-E, topotypes of *Hornera eburnea* , MOM; F, from " *Jean Charcot* " 1971, stn 161, MNHN): A, colony (× 3.0); B, detail of A showing gastro- and dactylopore arrangement, gastropore lips (× 18); C, detail of A, opposite face showing *Pedicularia* trace (× 5.9); D, colony (× 3.1); E, slender colony with bulging female ampullae (× 4.6); F, colony (× 3.3).

Lepidopora sp. A, branched specimens close to *L. eburnea* (G-H, from " *Noroit* " DW-21, MNHN; I-K, from " *Noroit* " DW-78, MNHN): G, branched distal fragment showing gastro- and dactylopore arrangement (× 3.8); H, nearly complete bifurcate colony showing bulging ampullae (× 4.1); I, colony bifurcate in upper part (× 4.1); J, repeatedly branched specimen showing gastro- and dactylopore arrangement and bulging ampullae (× 4.1); K, branched distal fragment, like J (× 4.1).

according to his annotations preserved at the RMNH). Additional topotypic specimens are at the BMNH (1977.8.2.1, 3 colonies) and at the MNHN (10 colonies, branches and minor fragments).

Type locality: Given by BOSCHMA (1963a) as " *Talisman* " expedition dredging no. 120, Azores, 560 m. The data available to BOSCHMA were incomplete and partly incorrect. The correct data are: " Talisman " drag. 123, 13.8.1883, 38°23'N, 28°49'45"W, 560 m. Azores.

MATERIAL STUDIED

Azores: Prince of Monaco stn 229, 2 small colonies + branch, topotypes of *Hornera eburnea* (MOM); stn 597 (?), 3 small branches, labeled [by CALVET ?] Hornera eburnea (MOM). — " *Talisman* " drag. 123, about 15 colonies, branches and fragments including holotype of E. (L.) *hicksoni* (BMNH 1964.9.17.11, 1977.8.2.1; MNHN); drag. 128, 3 small branches (MNHN). — " *Jean Charcot* " 1971, stn 159, 3 colonies (MNHN); stn 161, 2 colonies (MNHN); stn 213, 4 colonies (MNHN); stn 229, 3 small colonies + branch (MNHN); unknown station, about 60 colonies, branches and fragments (most MNHN; USNM 75600). — " *Bartlett* " 1975, stn 2, branch (ZMUK); stn 4, branch (ZMUK).

DESCRIPTION

Colonies uniplanar, with regular dichotomous branching forming V-shaped to U-shaped axils (Fig. 1 A-E, 2 A). Examined specimens up to 25 mm high and 35 mm wide; holotype of *Hornera eburnea* slightly taller (40 mm). Branches circular in cross section, tapering to slender tips about 0.45 mm in diameter. Coenosteum white and linear-imbricate (Fig. 2 F-G), composed of well-ordered parallel strips each 0.11-0.12 mm wide. Strips not well defined, bordered by an alignment of narrow coenosteal pores 20-30 µm long. Platelets irregular in width but rarely extend across entire strip.

Gastropores occur primarily on anterior face, each about 0.25 mm in diameter and often bordered by a small proximal lip. Gastropore lip does not actually cover any of gastropore (Fig. 1 B) but, rather, gives anterior directionality to gastrozooid. Illustrated gastrostyle (Fig. 2 J) 0.50 mm tall and 0.16 mm in basal diameter (H:W = 3.13); gastrostyles measured by BOSCHMA (1963a) slightly more slender (H:W = 3.75). Gastrostyle unridged and acutely conical with a pointed tip. Extremely large spines cover gastrostyle in a random arrangement; spines up to 68 µm long and 10 µm in diameter. Gastropore tube smooth; no ring palisade. According to BOSCHMA (1963a), gastrostyles occupy only lower one-sixth of gastropore tube.

Mound shaped dactylopores (Fig. 1 B, 2 D) occur mainly on anterior branch faces and lateral branch edges. Dactylopores often linearly arranged on branch edges in series of 5-9 but randomly arranged on branch faces. Dactylopores 50-70 µm in diameter, quite short (rarely more than 60 µm tall), and projecting perpendicularly to slightly anteriorly from branch.

Female ampullae massive, superficial, elliptical mounds (Fig. 1 E, 2 H) about 0.9-1.1 mm in diameter, the greater axis aligned with branch axis. When mature, female efferent pore located at distal vertex of ellipse, a concavity about 0.16 mm in diameter. Female ampullae occur on both branch faces and often in series of two or three. Male ampullae smaller, about 0.7 x 0.5 mm in diameter, superficial on branch tip but internal in larger diameter branches.

COMPARISONS

Eleven valid species of *Lepidopora* (13, counting the 2 unnamed species included herein) have been described: 6 from the Atlantic, 2 from the Subantarctic off South America, 1 from South Africa, and 2 from New Zealand (CAIRNS, 1983b, 1985, 1986a). *L. eburnea* can be distinguished from all congeners by its dactylopore arrangement: short rows on lateral branch edges in addition to dactylopores randomly scattered on anterior face. It is also characterized by having very short

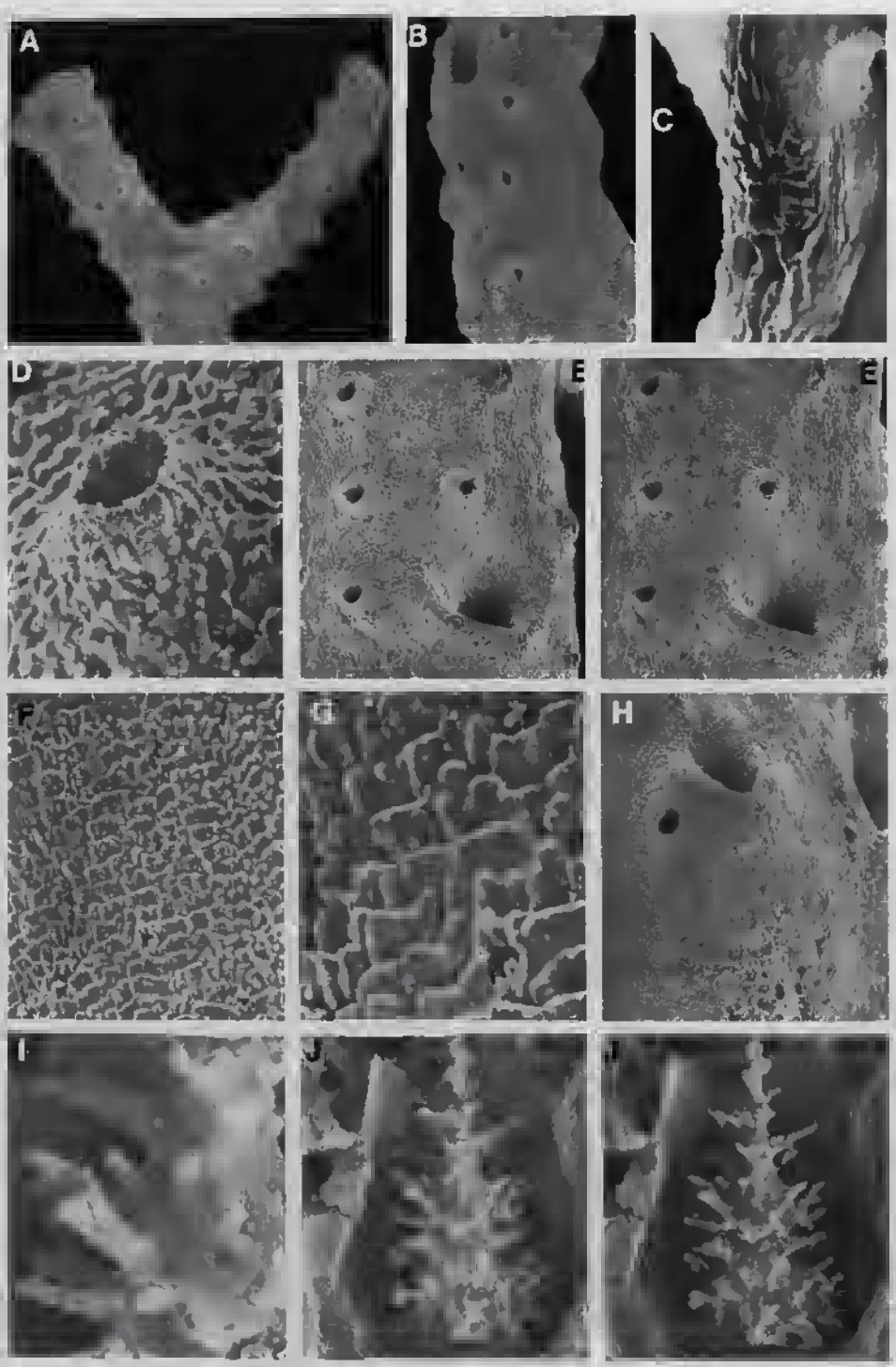

FIG. 2. — *Lepidopora eburnea* (A-B, D, F, G, from " *Talisman* " drag. 123, BMNH 1977.8.2.1; C, E, H-J, from " *Jean Charcot* " 1971, unknown station, Azores, female, USNM 75600): A, distal branch showing arrangement of gastro- and dactylopores (× 18); B, branch edge illustrating a row of dactylopores (× 29); C, *Pedicularia* trace (× 17); D, conical dactylopore (× 252); E, detail of branch surface showing gastropore, several aligned dactylopores, and coenosteal texture (× 33, stereopair); F-G, coenosteal texture (× 121, × 300, respectively); H, female ampulla (× 41); I, gastrostyle spines (× 289); J, gastrostyle (× 97 stereo pair).

dactylopore spines and a relatively low gastrostyle H:W ratio. Only one other species of *Lepidopora* is known to have linear-imbricate coenosteal texture, the western Atlantic *L. carinata* (Pourtalès, 1867), which can be distinguished by its distinctively shaped, ridged dactylopore spines; ring palisade; and complete absence of gastropore lips. Comparisons of *L. eburnea* to the 2 unnamed species (*Lepidopora* sp. A and sp. B) are made in the accounts of the latter.

Remarks

L. eburnea was considered at first as a bryozoan and described as *Hornera eburnea* by Calvet (1903). Calvet (1906) also recognized *H. eburnea* in the " *Talisman* " collection, still considering it as bryozoan. We agree that his material from " *Talisman* " drag. 128 (Azores) is typical L. eburnea, but we consider the stylasterid from " *Talisman* " drag. 96 (Mauritania) to be problematical, possibly a distinct species (see Lepidopora sp. A). Only much later Calvet became aware that his *Hornera eburnea*, as well as two other supposed bryozoans described by him (*H. verrucosa* and *H. gravieri* — see *Errina dabneyi* and *Pliobothrus symmetricus*), were stylasterid hydrocorals (Calvet, 1931: 45-46). This rectification had been reiterated in the bryozoan literature by Borg (1944: 203) and Cook (1968: 238).

Hickson (1912b) erroneously referred specimens from the Azores (" *Talisman* ") to *Pliobothrus tubulatus* (Pourtalès, 1867), a species known only from the western Atlantic (Cairns, 1986a). Intending to correct this confusion, and being unaware of Calvet's Hornera eburnea, Boschma (1963a) erected a new species, *Errina* (*Lepidopora*) *hicksoni*, which he mentioned again in later papers. It lists as *Lepidopora hicksoni* in Cairns' (1983b) check list, in which the former subgenus *Lepidopora* had been elevated to generic rank. The " transphyletic " synonymy of Boschma's stylasterid with Calvet's bryozoan was noted by Zibrowius (1981).

Distribution and ecology

The typical branched form of *L. eburnea* is known from about 10 stations in the Azores at depths ranging from 480 m to 983 m.

Some branched colonies of *Lepidopora* from Seine Seamount (235 m) and Gorringe Seamount (460-545 m) between Madeira and Portugal resemble the Azorean *L. eburnea* (see *Lepidopora* sp. A).

Symbionts

In the Azores, *L. eburnea* is frequently inhabited by *Pedicularia*. Two small specimens of this gastropod have been obtained from branches from an unknown station (" *Jean Charcot* " 1971, cruise biaçores) and the characteristic traces (Fig. 1 C, 2 C) have also been found on material from several other stations (" *Talisman* " drag. 123; " *Jean Charcot* " 1971, cruise biaçores, stn 161, 213, 229; " *Bartlett* " 1975, stn 2, 4). Material with *Pedicularia* traces includes the holotype, paratype, and topotypic specimens of *Errina* (*Lepidopora*) *hicksoni*; the trace on the paratype is obvious on two illustrations published by Boschma (1963a, pl. 1, fig. 2-3).

Lepidopora sp. A

Fig. 1G-K, 3 A-U, 4 A-E

Chresonymy:

Hornera eburnea — Calvet, 1906: 479 (part, " *Talisman* " drag. 96, Mauritania).
Errina (*Lepidopora*) *eburnea* — Zibrowius, 1981: 982 (part: " *Talisman* " drag. 96, Mauritania).

FIG. 3. — *Lepidopora* sp. A (A-E, from " *Talisman* " drag. 96, MNHN; F, from " *Cryos* " CP-95, MNHN; G-J, from " *Calypso* " 1958, SME-1277, MNHN; K-M, from " *Noroit* " DE-10, MNHN; N-0, from " *Noroit* " CP-12, MNHN; P, from " *Noroit* " CP-11, MNHN; Q-S, from " *Noroit* " DE-13, MNHN; T-U, from " *Noroit* " DW-108, MNHN): A, clavate form, same specimen as FIG. 4 A, opposite face illustrating gastro- and dactylopore arrangement (× 11); B, clavate form, more eroded specimen with less regular gastro- and dactylopore arrangement (× 11); C-D, slender form, distal branch fragments showing gastro- and dactylopores (× 11); E, clavate form, larger eroded specimen (× 8.3); F, lower part of colony with bulging ampulla and eroded surface (× 14); G-H, lower part of colonies (× 9.1, × 3.8, respectively); I-J, two faces of distal end of H showing gastro- and dactylopore arrangement, I also showing internal ampullae (× 9.8); K, eroded strongly clavate colony showing gastropores and large efferent pores of internal ampullae (× 3.5); L, nearly complete slightly clavate colony showing gastro- and dactylopore arrangement (× 4.1); M, nearly cylindrical curved colony showing bulging ampullae and distal dactylopores arranged in several ridges (× 4.1); N, cylindrical colony dichotomous in distal part (× 2.8); O, distal part of N, opposite face (× 4.6); P, eroded clavate colony showing gastropores and large efferent pores of internal ampullae (× 4.1); Q, incomplete clavate, like P (× 4.1); R, eroded clavate colony, incomplete, showing many large efferent pores of internal ampullae (× 4.1); S-T, slender cylindrical colonies (× 4.1); U, eroded clavate colony showing gastro- and dactylopores and large efferent pores of internal ampullae (× 4.1).

Lepidopora sp. B (V, from " *Challenger* ", stn 85, BMNH 1890.4.11.24): V, unique specimen, branch face illustrating gastro- and dactylopore arrangement (× 5.7).

Material studied

Galicia, Gorringe and Seine Seamounts: " *Calypso* " 1958, stn SME-1277, 5 incomplete colonies, dead (MNHN). — " *Noroit* " 1987, cruise SEAMOUNT 1, stn DW-8, 6 specimens, basis or lower part of colonies (MNHN); stn DE-10, 9 specimens, mostly fragments, lower or upper parts (MNHN); stn CP-11, 18 specimens, including bases, incomplete and complete unbranched colonies, dead (MNHN); stn CP-12, 17 specimens, including lower and distal parts, unbranched colonies (MNHN); stn DE-13, ca. 70 specimens including bases and nearly complete unbranched colonies (MNHN); stn DW-21, 45 specimens, including bases, various fragments and incomplete colonies, many pieces branched (MNHN); stn CP-30, 3 specimens, including complete unbranched colony (MNHN); stn DW-78, 45 specimens including bases, lower parts and various fragments, many pieces branched (MNHN); stn DW-108, 13 specimens including various fragments, from base to nearly complete unbranched colony (MNHN); stn DW-111, 2 incomplete unbranched colonies (MNHN); stn DW-116, lower part of colony (MNHN).

Morocco: " *Cryos* " 1984, cruise BALGIM, stn CP-95, incomplete colony, dead (MNHN).

Mauritania: " *Talisman* " drag. 96, 12 colonies, some of them incomplete or in two pieces (MNHN).

Description

The first samples of *Lepidopora* obtained from Gorringe Seamount (" *Calypso* " 1958, stn SME-1277) comprise the lower part of 5 colonies (part of them considerably corroded). They are unbranched, up to 12 mm high, cylindrical, and decrease in diameter to the distal fracture (Fig. 3 G-J). Gastropores and dactylopores occur on all sides. Ampullae are internal.

Further material obtained from Gorringe Seamount (" *Noroit* " 1987, cruise SEAMOUNT 1, stn DW-8, DE-10, CP-11, CP-12, DE-13, DW-21, CP-30) is morphologically variable (Fig. 2 G-H, 3 K-S), but includes many tiny fragments, often in poor condition. Many pieces, including complete colonies, are similar to the earlier " *Calypso* " material: cylindrical and unbranched, up to 15 mm high and 1.5-3.3 mm in diameter. Ampullae internal to slightly bulging near distal end. Other unbranched specimens of similar size (up to 18 mm high) tend to a clavate shape, with intermediates from almost cylindrical to considerably widened in the upper part. Ampullae typically bulging, even vaguely packed into four straight lines in some specimens. A large transverse orifice up to twice as wide as a gastropore can be found in the distal part of bulging ampullae, but may be obstructed by calcareous deposit (Fig. 3 K, P, Q, R, U).

In addition to the unbranched, either slender cylindrical or clavate specimens, some lots from Gorringe Seamount (stn DW-10, CP-12, DW-21) comprise branched fragments or incomplete colonies, with either internal or bulging ampullae. The better preserved bifurcating specimen from stn DE-10 is 7.5 mm high and its terminal branches are slightly clavate with distinct bulging ampullae (Fig. 3 N-O). The unique bifurcating colony from from stn CP-12 is 22.5 mm high and cylindrical all along, with an average diameter of 2.4 mm. It bifurcates only in the upper third. Ampullae are not evident externally. Most pieces of the large lot from stn DW-21, up to 18 mm high and 3 mm in diameter, are branched (occasionally more than once) and show distinct ampullae.

Material from Seine Seamount (stn DW-78, Fig. 1 I-K) consists of one larger lot of mostly branched (and corroded) specimens similar to those from Gorringe Seamount (stn DW-21, Fig. 1 G-H). A few slender cylindrical unbranched specimens are also present, but no clavate ones.

Material from Galicia Seamount (stn DW-108, DW-111, DW-116) includes subcylindrical to clavate unbranched specimens (maximum size 15.5 mm, Fig. 3 T-U). A poorly preserved specimen looks branched, unless it results from specimens being attached one on the other.

All well preserved *Lepidopora* from the three seamounts resemble the Azorean *L. eburnea* by having white, linear-imbricate coenosteum composed of parallel strips. Gastropores may have distinct proximal lip. Gastrostyles are similar to those of *L. eburnea*, as are the dactylopores.

The unique specimen from Morocco (" *Cryos* " 1984, cruise BALGIM, stn CP-95), in very bad condition, is the lower part (6.5 mm high) of a small mature colony (ampullae present) (Fig. 3 F). Its diameter increases from the narrowest zone just above the encrusting base to the distal fracture and thereby is similar to clavate specimens from Gorringe Seamount and Mauritania.

Material from Mauritania (" *Talisman* " drag. 96) first mentioned by CALVET (1906) comprises 15 small unbranched pieces in poor condition. Some of these, belonging together, can be recombined into more complete colonies. Two forms can be distinguished on the basis of their general aspect.

The slender form (Fig. 3 C-D, 4 C-D) is slightly sinuous, thin, subcircular in cross section, and of rather uniform diameter. It is represented by 3 specimens, the largest of which (incomplete, base missing) is 7 mm high and up to 1.8 mm wide. The clavate form (Fig. 3 A-B, D, 4 A-B) is rather massive, straight, subcircular to slightly flattened in cross section, and notably wider in the upper part (Fig. 4 A). It is represented by 12 pieces, corresponding to 9 colonies, the largest of which (incomplete, base missing), is 10 mm high and up to 2.5 mm wide in the upper part. Distal branch tip of this form about 1.6 mm in diameter.

Both forms have white, linear-imbricate coenosteum composed of parallel strips about 0.15 mm wide. Their platelet structure (Fig. 4 C), although worn in all specimens, is very similar to that of *L. eburnea*.

Gastropores 0.32-0.44 mm in diameter, each bordered by a proximal lip, which is slightly more prominent in several of the clavate specimens (Fig. 4 A-B, 4 D-E). Gastrostyles could not be examined.

Conical to tubular dactylopore spines occur in lines on lateral branch edges as well as sparsely scattered on branch faces (Fig. 4 A-B, 4 D-E). Dactylopores 67-80 µm in diameter and up to 0.25 mm tall, directed perpendicular to branch surface. Dactylopore centers about 0.37 mm apart.

Ampullae (female ?) superficial, about 0.55 mm in diameter. No efferent pores noted.

COMPARISONS

The northeastern Atlantic stylasterids here provisionally grouped under *Lepidopora* sp. A appear to reflect a disconcerting range of colony shape. Although we can see differences especially between the end points, i.e. the typical Azorean *L. eburnea* and the distinctive clavate form from Gorringe Seamount and Mauritania, we hesitate to draw a line. All these forms are clearly similar in coenosteal texture; dactylopore arrangement ; gastropore lips; female ampullar size, location, and efferent pore location; and gastrostyle shape. Structural uniformity thus constrasts with variation in colony shape. Typical Azorean *L. eburnea* is repeatedly branching, whereas the clavate form is typically unbranched (as is the slender cylindrical form, with intermediates tending to the clavate one). But there are transitional specimens (occasionally with a clavate tip) that have long sections without bifurcation resulting in consequently smaller colonies. We are not sure that slight size difference, such as larger gastropores, higher and larger dactylopore spines, and wider coenosteal strips are consistent and should be considered as essential arguments for species distinction.

Our comparison may also be biased by the lack of early ontogenetic stages and young colonies of typical *L. eburnea* from the Azores, sorting of dredge contents on " *Jean Charcot* " cruise BIAÇORES having been less detailed than on " *Noroit* " cruise SEAMOUNT 1. Obviously more well preserved specimens, including from intermediate areas, must be examined to better understand this group.

REMARKS

Stylasterids from 2 stations of the " *Talisman* " were referred by CALVET (1906) to the species he had previously described from the Azores and mistaken for a bryozoan. In fact, CALVET's specimens from drag. 128 (Azores) are typical *Lepidopora eburnea*, whereas those from drag. 96 (Mauritania) are here included under *Lepidopora* sp. A (distinction not yet made by ZIBROWIUS, 1982).

Distribution and ecology

Stylasterids here grouped under *Lepidopora* sp. A are known from Galicia Seamount (675-1125 m), Gorringe Seamount (470-2075 m), Seine Seamount (235 m), off Morocco (1378 m), and off Mauritania (2320-2330 m), i.e. from a wider depth range than typical *L. eburnea* in the Azores. Unbranched specimens, slender cylindrical and clavate, occur down to the greatest depths, whereas specimens more similar to *L. eburnea* were obtained on the seamounts only at shallower depths (235-545 m).

No symbionts are known.

Lepidopora sp. B

Fig. 3 V, 4 F-H

Material studied

Canary Islands: " *Challenger* " stn 85, dorsoventrally flattened fragment (BMNH 1890.4.11.24); 3 minor cylindrical fragments from same lot are specifically different and not considered here (accidental mixture in museum collection ? indication of origin reliable ?).

Description

The study material consists of one dorsalventrally flattened, slightly sinuous unbranched upper branch fragment (Fig. 3 V) without the distal end, 10.5 mm high and 1.5 mm wide at the widest point. Coenosteal strips 0.12 mm wide, covered by small granules. Five gastropores arranged along midline of anterior face, each bordered by a very broad crescent shaped proximal lip (Fig. 4 G-H) about 0.7 mm wide and 0.3 mm deep. Elongate gastrostyles present but not available for detailed study. Dactylopore mounds linearly arranged along each lateral branch edge, their centers about 0.43 mm apart. Dactylopores elliptical (e.g. 78 x 56 µm in diameter), the greater axis aligned with the branch axis (Fig. 4 G). Dactylopore mounds about 0.15 mm tall and 0.18 mm in diameter. Superficial swellings (? female ampullae) occur proximal to each gastropore on anterior face and in a staggered arrangement on posterior face, each about 0.7 mm in diameter. No efferent pores observed.

Comparisons

Lepidopora sp. B is similar to *Lepidopora* sp. A (clavate form), particularly regarding its flattened branches and lateral rows of dactylopore mounds. *Lepidopora* sp. B differs in coenosteal texture (granular, not linear-imbricate), having extremely prominent gastropore lips, lacking dactylopores on branch faces, and having elliptical dactylopores (not circular).

Compared to typical *L. eburnea* from the Azores, *Lepidopora* sp. B has much broader gastropore lips, larger dactylopores, and only two lateral rows of dactylopores. It is similar to the western Atlantic *L. glabra* (Pourtalès, 1867) in dactylopore − gastropore coordination, but the coenosteal texture is quite different.

Remarks

At the BMNH the unique sample of *Lepidopora* sp. B was found labeled " Hydrocorallinae Stylasteridae ". Moseley (1881) probably had not seen it when he studied the " *Challenger* " stylasterids.

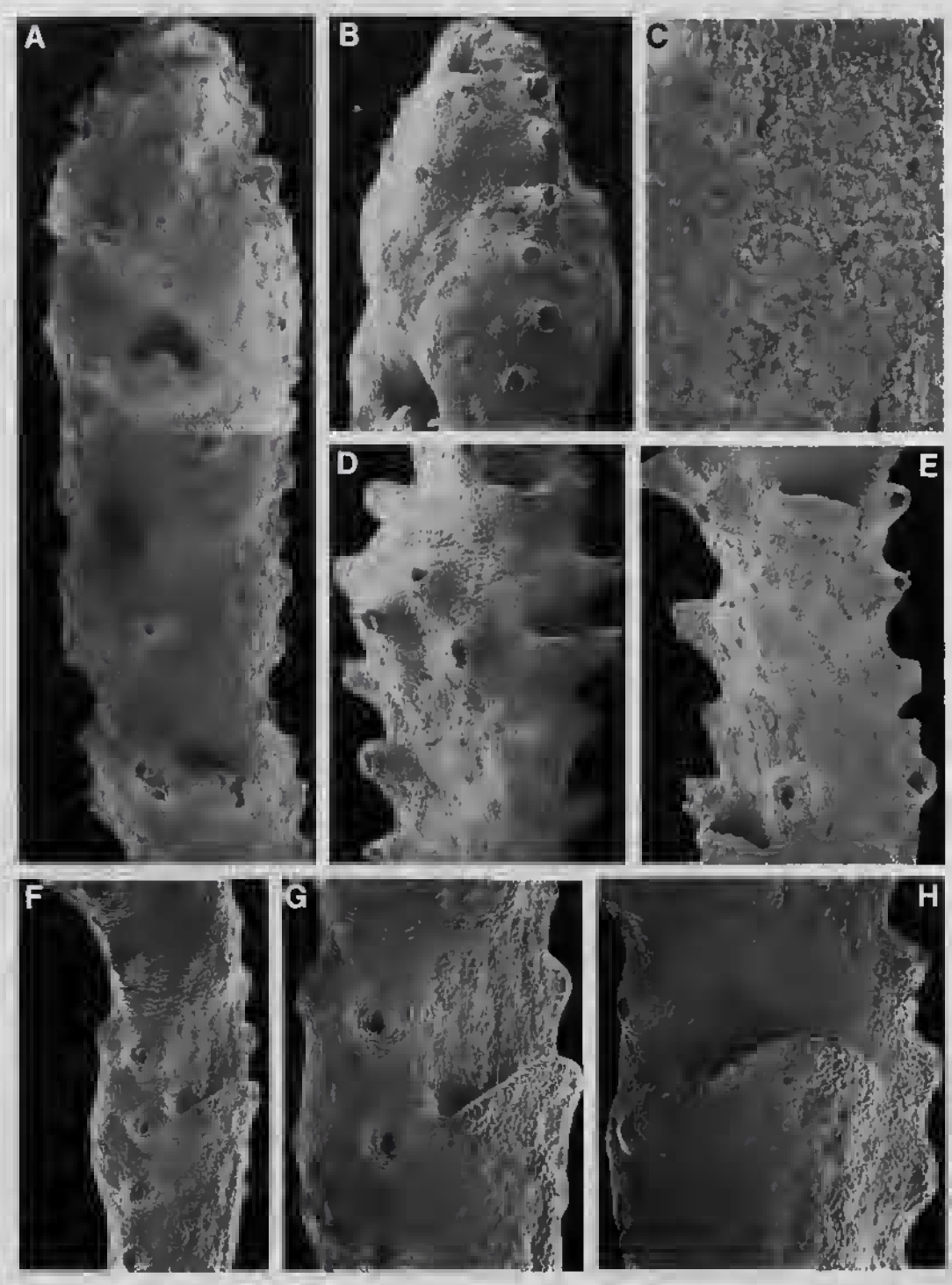

FIG. 4. — *Lepidopora* sp. A (A-E, from " *Talisman* " drag. 96, MNHN): A, clavate form, distal branch face illustrating gastro- and dactylopores (× 23); B, clavate form, distal branch edge showing aligned dactylopores and proximal gastropore lip (× 26); C, slender form, coenosteal texture (× 116); D-E, slender form, branch faces of two female (?) specimens (× 28, × 29, respectively).

Lepidopora sp. B (F-H, from " *Challenger* " stn 85, BMNH 1890.4.11.24): F-H, lateral, oblique, and top views of branch fragment illustrating dactylopores and proximal gastropore lip (× 23, × 40, × 40, repectively).

DISTRIBUTION AND ECOLOGY

Lepidopora sp. B is known from only one station in the Canary Islands, at a much greater depth (2100 m) than the typical Azorean *L. eburnea*.

No symbionts are known.

Genus *PLIOBOTHRUS* Pourtalès, 1871

Diagnosis. — Gastro- and dactylopores randomly arranged. Coenosteal texture linear-imbricate; coenosteal pores large. Gastropore tube double-chambered (see CAIRNS, 1983b: 439); no gastrostyles. Dactylopore spines conical or tubular; dactylopore tubes quite long; no dactylostyles. Ampullae usually internal.

Type species: *Pliobothrus symmetricus* Pourtalès, 1868, from the western Atlantic.

Pliobothrus is represented in the study area by 2 species, including the type species.

Pliobothrus symmetricus Pourtalès, 1868
Fig. 5 A-G, 6 A-G

Synonymy:

Pliobothrus symmetricus Pourtalès, 1868: 141.
Hornera gravieri CALVET, 1911: 7, fig. 5.

Chresonymy:

Pliobothrus symmetricus — DUNCAN, 1870: 290, 297; 1873: 336, pl. 49, fig. 7. — POURTALÈS, 1871: 57, pl. 4, fig. 7-8; 1878: 211. — MOSELEY, 1879: 469, 479, 440-442 (Florida), pl. 41, fig. 2 (part, NOT " *Challenger* " stn 23, Sombrero Island); 1881: 47-50, 78, 84, pl. 8, fig. 2 (part, NOT " *Challenger* " stn 23, Sombrero Island). — AGASSIZ, 1888: 138-139, fig. 444. — NUTTING, 1895: 84. — HICKSON, 1912b: 465-466. — BROCH, 1914a: 3-7, pl. 1, fig. 1-3, pl. 3, fig. 19-20, 28-29, pl. 4, fig. 34, 40-42, text-fig. A-B. — DONS, 1939: 196-197, fig. 1. — BOSCHMA, 1956b: F104, fig. 85.1a-b; 1957a: 59-60; 1967: 333-335, pl. 1, fig. 5-6. — SQUIRES, 1965: 24, pl. 2, fig. 7-8. — ZIBROWIUS, 1981: 269; 1982: 982 (part, NOT Hyères Seamount). — ZIBROWIUS & CAIRNS, 1982: 211, 212 (part, NOT Hyères Seamount). — CAIRNS, 1983b: 428, 439-441, fig. 3A-H, 24G, 25G, 27B (part, NOT stn J-S 43); 1986a: 16-17, fig. 6A-H (part, NOT Hyères Seamount).
Hornera gravieri — CALVET, 1931: 46. — BORG, 1944: 203.

TYPES

Pliobothrus symmetricus: In the original description POURTALÈS (1868) simply reported *P. symmetricus* as being " not rare between 100 and 200 fathoms off the Florida reef ". In a later more detailed and illustrated description (POURTALÈS, 1871) he reported the species from 7 dredging stations in the same area. CAIRNS (1983b: 441) selected one of these as type locality and designated a lectotype (colony illustrated by POURTALÈS, 1871, pl. 4, fig. 7; CAIRNS, 1983b, fig. 3 A; CAIRNS, 1986a, fig. 6 A) and a paralectotype, among material deposited at the MCZ (5529, 5530, respectively). The YPM possesses another paralectotype (CAIRNS, 1986a).

Type locality: Restricted by CAIRNS (1983b) to " *Bibb* " stn 64, 11.5.1868, 24°17'N, 81°43'W, 262 m. Off Sand Key/Key West, Florida.

Hornera gravieri: CALVET (1911) reported *H. gravieri* from 11 stations in the Azores (Prince of Monaco stn 568, 584, 597, 616, 618, 683, 712, 719, 838, 866, 869) and mentioned " several beautiful colonies and many fragments ". CALVET did not designate the type locality and select types. None of the specimens seen by CALVET could be found and all may be lost (see ZIBROWIUS, 1982).

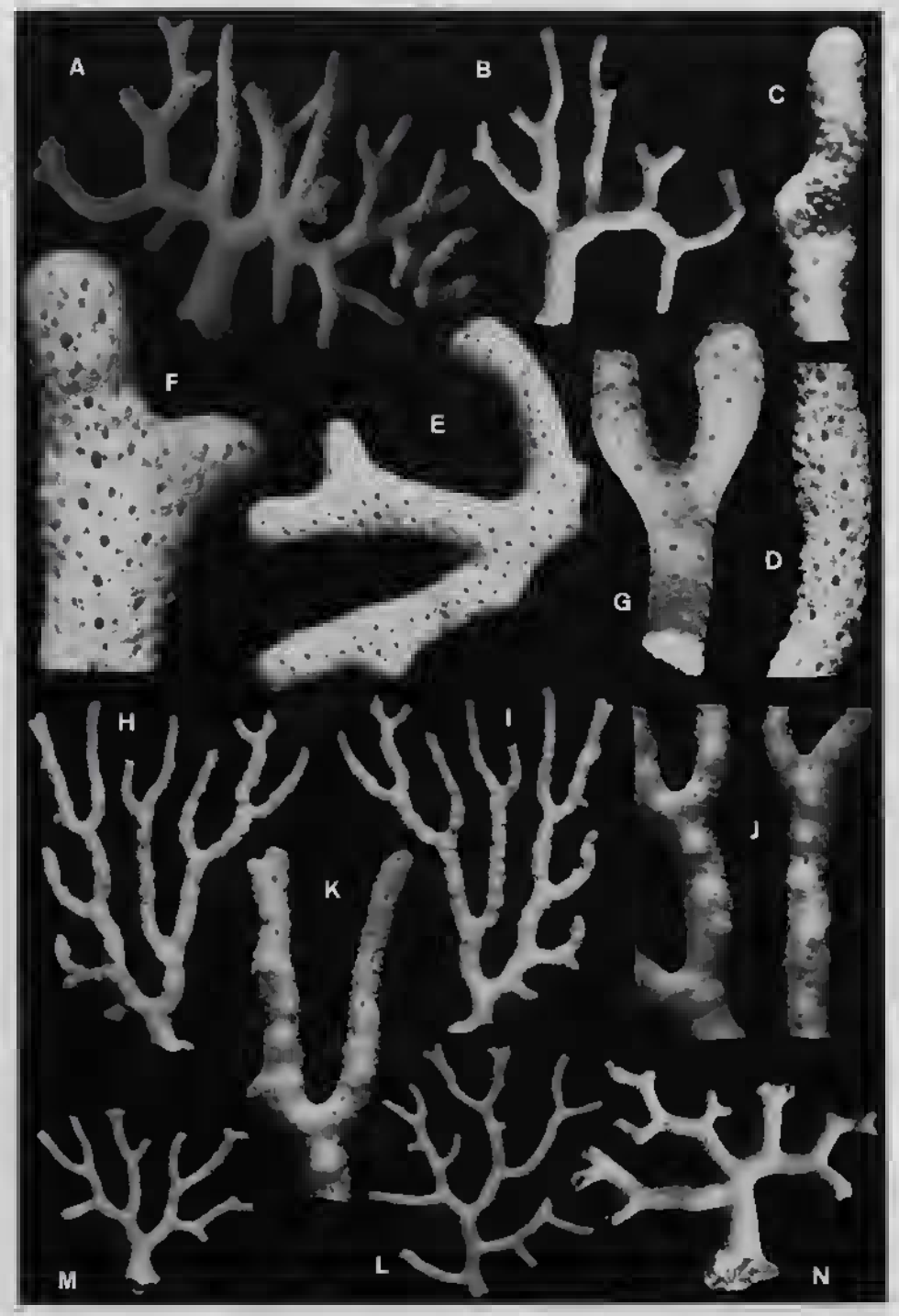

FIG. 5. — *Pliobothrus symmetricus* (A, from " *Talisman* " drag. 123, MNHN; B, from " *Jean Charcot* " 1971, unknown station, Azores; C-D, from " *Thalassa* " z-435, MNHN; E-F, from " *Thalassa* " z-407, MNHN; G, from " *Challenger II* " 1977, stn 134, BMNH 1986.11.5.2): A, large colony (× 1.3); B, colony (× 1.1); C, distal branch with *Pedicularia* trace (× 3.3); D, branch illustrating gastro- and dactylopore arrangement (× 3.3); E, distal part of colony (× 1.8); F, detail of E illustrating gastro- and dactylopores (× 4.1); G, dichotomous branch (× 2.4).

Pliobothrus gracilis (H-L, from " *Calypso* " 1959, drag. 6, MNHN; M-N, from " *Calypso* " 1959, drag. 4, MNHN) : H-I, holotype, opposite faces (both × 1.7); J-K, details from holotype with bulging female ampullae (both × 3.0); L-N, paratypes (all × 1.3).

MATERIAL STUDIED

W Atlantic: Lectotype and paralectotype of *P. symmetricus* and additional specimens identified by POURTALÈS (MCZ; BMNH 1869.1.25.16, 1891.2.4.42, 1891.12.18.1).

Faroes: "*Michael Sars*" 25.2.1904, colony + fragments (VSM).

Faroes – Hebrides area: "*Porcupine*" 1869, station data uncertain, colony + branch (BMNH 1883.12.10.131, 1898.5.7.17).

W Ireland: "*Challenger II*" 1977, stn 134, 4 branches (BMNH 1986.11.5.2). "*Challenger II*" 1981, stn 30, colony (BMNH 1989.6.16.1).

Celtic Sea: "*Thalassa*" stn Z-407, branch (MNHN); stn Z-415, distal branch fragment (MNHN); stn Z-435, 31 colonies + 60 branches/fragments (most MNHN; USNM 77121).

S Bay of Biscay: "*Travailleur*" drag. 70, branch (MNHN).

Galicia and Josephine Seamounts: "*Noroit*" 1987, cruise SEAMOUNT 1, stn DW-56, 6 fragments (MNHN); stn DW-58, 3 fragments (MNHN); stn DW-111, 2 poorly preserved fragments, probably of *P. symmetricus* (MNHN).

Madeira Archipelago: "*Jean Charcot*" 1966, stn 49, 4 poorly preserved fragments probably of *P. symmetricus* (MNHN).

Azores: "*Talisman*" drag. 123, colony (MNHN). — "*Jean Charcot*" 1971, cruise BIAÇORES, stn 34, branch (MNHN); stn 161, colony + 2 branches (MNHN); stn 197, colony (MNHN); stn 213, colony (MNHN); stn 218, 4 colonies + fragments (most MNHN; USNM 75601); stn 229, 5 colonies + 2 branches (MNHN); stn 231, 12 colonies + 9 branches (most MNHN; USNM 77120); stn 232, 4 colonies + 2 branches (MNHN); stn 240, 15 small colonies on pebbles, provisionally included here, identity uncertain — see comparisons (most MNHN; USNM 77119); unknown station, 2 colonies + fragments (MNHN).

Imprecise locality southwest of the Azores: said to come from seamount 260 miles (?) [475 km] southwest of Faial, ca. 500 m, fishing boat "*Tomiguel*", coll. J.G. PEREIRA, Sept. 1976, 2 colonies + 8 branches/fragments (MNHN).

DESCRIPTION

Eastern Atlantic specimens: colonies uniplanar, up to 60 mm high and 68 mm wide (Fig. 5 A-B). Branches robust, cylindrical to slightly flattened along branching plane, 2.5-3.0 mm in diameter. Branches gradually taper to blunt tips; branch axils U-shaped. Coenosteal strips 80-95 µm wide, separated by large, round to elongate pores up to 65 µm wide. Platelets variable in ornamentation, ranging from broad flat platelets (Fig. 6 F), to corrugated narrow platelets (Fig. 6 D-E), to an irregular arrangement of imbricating spines (Fig. 6 G). Sometimes two different textures occur on the same colony.

Gastro- and dactylopores occur on all branch surfaces but are more common on anterior branch face (Fig. 5 D-G). Gastropores round to slightly elliptical and 0.30-0.45 mm in diameter, although most colonies have some smaller diameter gastropores (e.g. 0.20 mm), which may reflect developing gastropores or a different size class. Dactylopore spines tubular, up to 0.20 mm tall and 0.15 mm in diameter, with a wall thickness of about 38 µm.

Female ampullae internal and 0.8-0.9 mm in diameter, communicating to branch surface by a tube that terminates in a spongy area on coenosteum 0.15-0.25 mm in diameter. Male ampullae also internal and round to elliptical, with greater axis perpendicular to branch surface. Male ampullae 0.3-0.4 mm long, terminating in a slit like efferent pore 0.05-0.11 mm long aligned with a coenosteal slit. Ampullae from western Atlantic material figured by CAIRNS (1986a) were female.

COMPARISONS

Of the 3 other species in the genus (all occurring in the Atlantic), *P. symmetricus* is distinguished from *P. tubulatus* (Pourtalès, 1867), by its shorter dactylopore spines and more robust

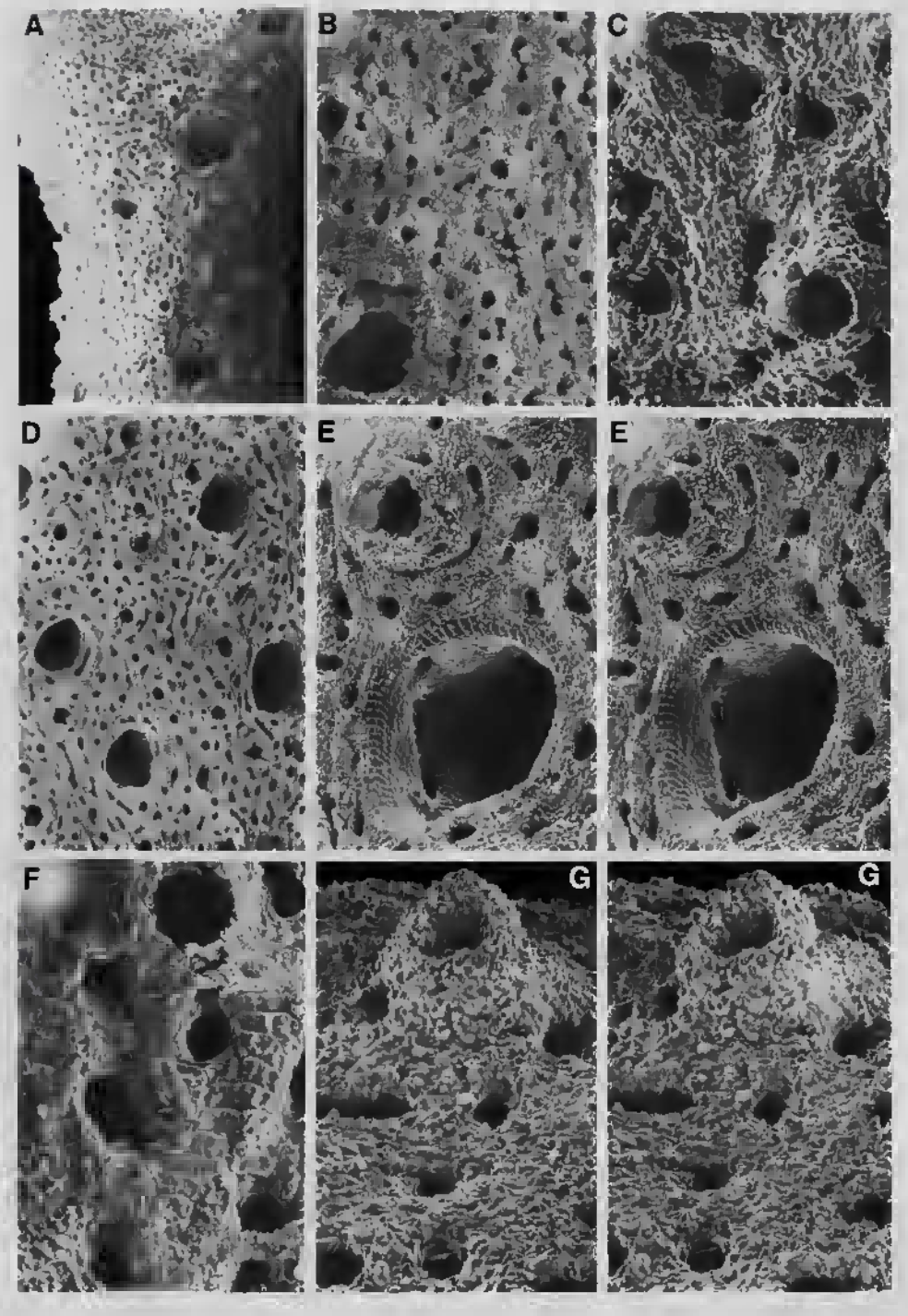

FIG. 6. — *Pliobothrus symmetricus* (A-C, from "*Jean Charcot*" 1971, stn 218, male, USNM 75601; D-E, from "*Thalassa*" z-435, male, USNM 77121; F, from imprecise "*Tomiguel*" locality, male, MNHN; G, from "*Talisman*" drag. 123, MNHN): A, branch face illustrating gastro- and dactylopores (× 11); B, gastropore and several dactylopores (× 33); C, dactylopore and coenosteal texture (× 96); D, branch face illustrating large gastropores, smaller dactylopores, and even smaller irregularly shaped coenosteal pores (× 19); E, detail of large gastropore and one dactylopore, coenosteal texture of narrow imbricate platelets (× 55, stereo pair); F, coenosteal texture of broad flat platelets (× 121); G, dactylopore and rough coenosteal texture of imbricate spines (× 119).

branches; from *P. echinatus* Cairns, 1986, by its nonspinose coenosteum and smaller gastropore diameter; and from *P. gracilis* n. sp., by its internal female ampullae and larger gastropores.

One lot of 15 specimens of *Pliobothrus* from the Azores (" *Jean Charcot* " 1971, cruise BIAÇORES stn 240) is specially discussed here (Fig. 7 A-I). These specimens are unlike any of the other known species of *Pliobothrus* in a number of characters. Their gastropores are circular and only 0.16-0.18 mm in diameter. Coenosteal pores are very narrow (e.g. 9 µm) producing a very dense coenosteal texture, not porous as in the other species. The dactylopore spines are conical mounds instead of thin walled tubes and all of the colonies are short and sparsely branched (or unbranched) with a firmly attached base. Several colonies bear low superficial female ampullae about 1 mm in diameter, invariably with an efferent pore on the upper (distal) edge of the ampulla.

REMARKS

P. symmetricus has occasionally been confused with each of the other species of *Pliobothrus* occurring in the western and eastern Atlantic (rectification in CAIRNS, 1986a, and herein). MOSELEY (1879, 1881) erroneously attributed to *P. symmetricus* a specimen of *P. tubulatus* (Pourtalès, 1867) from " Challenger " stn 23 (Sombrero Island, West Indies). Nevertheless, he based his detailed study of the skeleton and of the soft parts on authentic P. symmetricus (specimens from Florida, sent to him by POURTALÈS, cf. MOSELEY, 1879: 440; 1881: 47). CAIRNS (1983b) mistakenly included under *P. symmetricus* a record which he subsequently (1986a) tranferred to a new species, *P. echinatus* Cairns, 1986. In the eastern Atlantic *Pliobothrus gracilis* n. sp. from Hyères Seamount, described in this paper, had also erroneously been included under *P. symmetricus* (ZIBROWIUS, 1982 ; ZIBROWIUS & CAIRNS, 1982; CAIRNS, 1986a).

In the eastern Atlantic, *P. symmetricus* has been mistaken for a bryozoan, described as *Hornera gravieri* Calvet, 1911. Only much later CALVET (1931: 45-46) became aware that his *H. gravieri* was a stylasterid hydrocoral. This rectification was mentioned again by BORG (1944: 203) and COOK (1968: 238). The " transphyletic " synonymy of CALVET's (1911) bryozoan with POURTALÈS' (1868) stylasterid was noted by ZIBROWIUS (1982).

DISTRIBUTION AND ECOLOGY

In the western Atlantic, which includes the type locality of *P. symmetricus*, distribution and depth range have been studied by CAIRNS (1986a). The species occurs mostly between 150 m and 400 m from the Blake Plateau off South Carolina through the Lesser Antilles, including the Pourtalès Terrace off Florida.

In the eastern Atlantic *P. symmetricus* is known from many stations between 63°35'N and 31°26'N: southeast of Iceland, east of the Faroes, between the Faroes and the Hebrides, Norway (62°31'N and 62°15'N), west of Ireland, Celtic Sea, Bay of Biscay, Galicia and Josephine Seamounts, Madeira Archipelago (to be confirmed, presently available material in poor condition), Azores, and an unidentified seamount southwest of the Azores. We have seen material from most of these areas except from southeast of Iceland and from Norway; however, the specimens reported from these two areas have been adequately described and figured (BROCH, 1914a; DONS, 1939) and are included here without hesitation.

Its depth range in the eastern Atlantic is from 80 m and 250-300 m for the shallowest stations off Norway (DONS, 1939) to 1550 m and 1600 m for the deepest stations in the Azores (CALVET, 1911, as *Hornera gravieri*). It is unknown whether live material had been obtained at these deepest stations; in the Azores, with locally very irregular and steep slopes, dead specimens are occasionally collected at uncommonly great depths. The deepest confirmed record of live material is 1050 m in the Celtic Sea (" *Thalassa* " stn z-435).

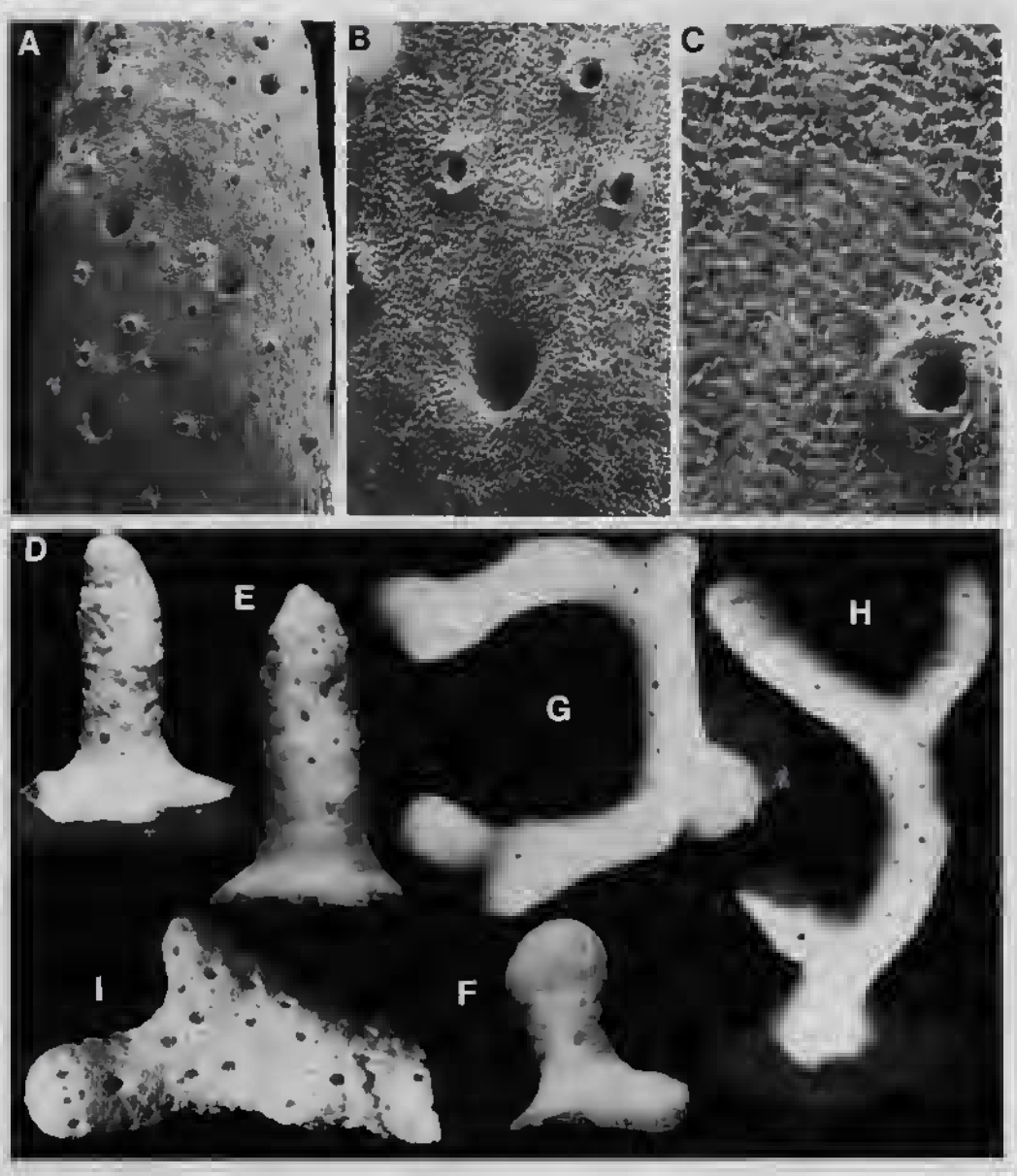

FIG. 7. — *Pliobothrus* sp. (A-I, from "*Jean Charcot*" 1971, stn 240, MNHN): A, tip of small unbranched colony illustrating several gastropores and more numerous smaller dactylopores (× 17); B, coenosteum bearing one gastropore and four dactylopores (× 49); C, detail of branch showing a dactylopore and coenosteal texture (× 76); D-F, small unbranched colonies (× 4.1, × 4.1, × 3.9, respectively); G-H, larger branched colonies (× 2.7, × 2.6, respectively); I, distal branch tip illustrating gastro- and dactylopore arrangement (× 3.9).

SYMBIONTS

In the northeastern Atlantic, *P. symmetricus* is the host of *Pedicularia*, but, curiously, among the abundant material studied here, only 3 branches from 2 stations in the Celtic Sea have been found with the characteristic traces of the gastropod ("*Thalassa*" stn z-415, z-435; Fig. 5 C).

MOSELEY (1879: 469; 1881: 78) reported parasitic organisms thought to be pycnogonid larvae from the gastric cavities of gastrozooids of *P. symmetricus* dredged off Florida by POURTALÈS. No similar association is yet known from the northeastern Atlantic.

Pliobothrus gracilis new species

Fig. 5 H-N, 8 A-G

Chresonymy:

Pliobothrus symmetricus — ZIBROWIUS, 1982: 982 (part: Hyères Seamount). — ZIBROWIUS & CAIRNS, 1982: 212 (part: Hyères Seamount). — CAIRNS, 1986: 17 (part: Hyères Seamount).

TYPES

Holotype and paratypes of *Pliobothrus gracilis* from 2 stations on slope of Hyères Seamount, " *Calypso* " 1959, drag. 4 and drag. 6. Holotype a female colony collected alive from drag. 6, without base (Fig. 5 H-I). Paratypes 3 colonies (2 with base) from drag. 4 and 3 colonies or branches (all without base) and 2 minor fragments from drag. 6; paratypes up to 30 mm high and 35 mm wide. Holotype and most paratypes at MNHN, 1 paratype from drag. 6 at USNM (77118).

Type locality: " *Calypso* " 1959, drag. 6, 13.8.1959, 31°27.7'N, 28°55.6'W, 620-700 m, Hyères Seamount.

MATERIAL STUDIED

Hyères Seamount: holotype and paratypes.

DESCRIPTION

Colonies uniplanar: holotype 38 mm high and 36 mm wide, paratypes smaller. Branches cylindrical, gradually tapering through regular dichotomous branching to blunt, rounded branch tips. Branches slender, subterminal branches 1.25-1.75 mm in diameter; branch axils U-shaped. Coenosteum linear-imbricate (Fig. 8 E), the strips 65-80 µm wide and of variable length, producing a very porous coenosteum. Platelets flat and irregularly shaped, about 25 µm wide, occurring three or four across a strip. Granular coenosteum sometimes also present on same specimen bearing linear-imbricate texture, the granules about 18 µm in diameter (Fig. 8 F).

Gastropores occur in low density on all branch surfaces but are most common on anterior face. Gastropores small and usually circular (e.g. 0.18-0.25 mm in diameter) but may also be elliptical, the greater axis parallel to branch axis (e.g. 0.29 x 0.19 mm). Dactylopore spines also scarce but most common on anterior branch face. Dactylopore spines tubular, up to 0.10 mm tall and 0.15 mm in diameter, with thin walls about 38 µm thick (Fig. 8 B).

Female ampullae superficial mounds (Fig. 5 J-K, 8 G) 1.0-1.2 mm in diameter occurring on both anterior and posterior branch faces. Efferent pores 0.17-0.19 mm in diameter and usually slightly off center from apex of bulge. Male ampullae not discerned in limited material available.

COMPARISONS

P. gracilis is distinguished from the other 3 species of *Pliobothrus* by its superficial female ampullae and very small gastropores. It is further distinguished from *P. symmetricus* by its very slender branches and low density of gastro- and dactylopores. *P. gracilis* is similar to the Azorean *Pliobothrus* from " *Jean Charcot* " 1971, cruise BIAÇORES stn 240 (see *P. symmetricus*, Comparisons) in having superficial female ampullae and small circular gastropores, but differs in other characters, such as: placement of efferent pore, coenosteal texture, colony size, and polyp density.

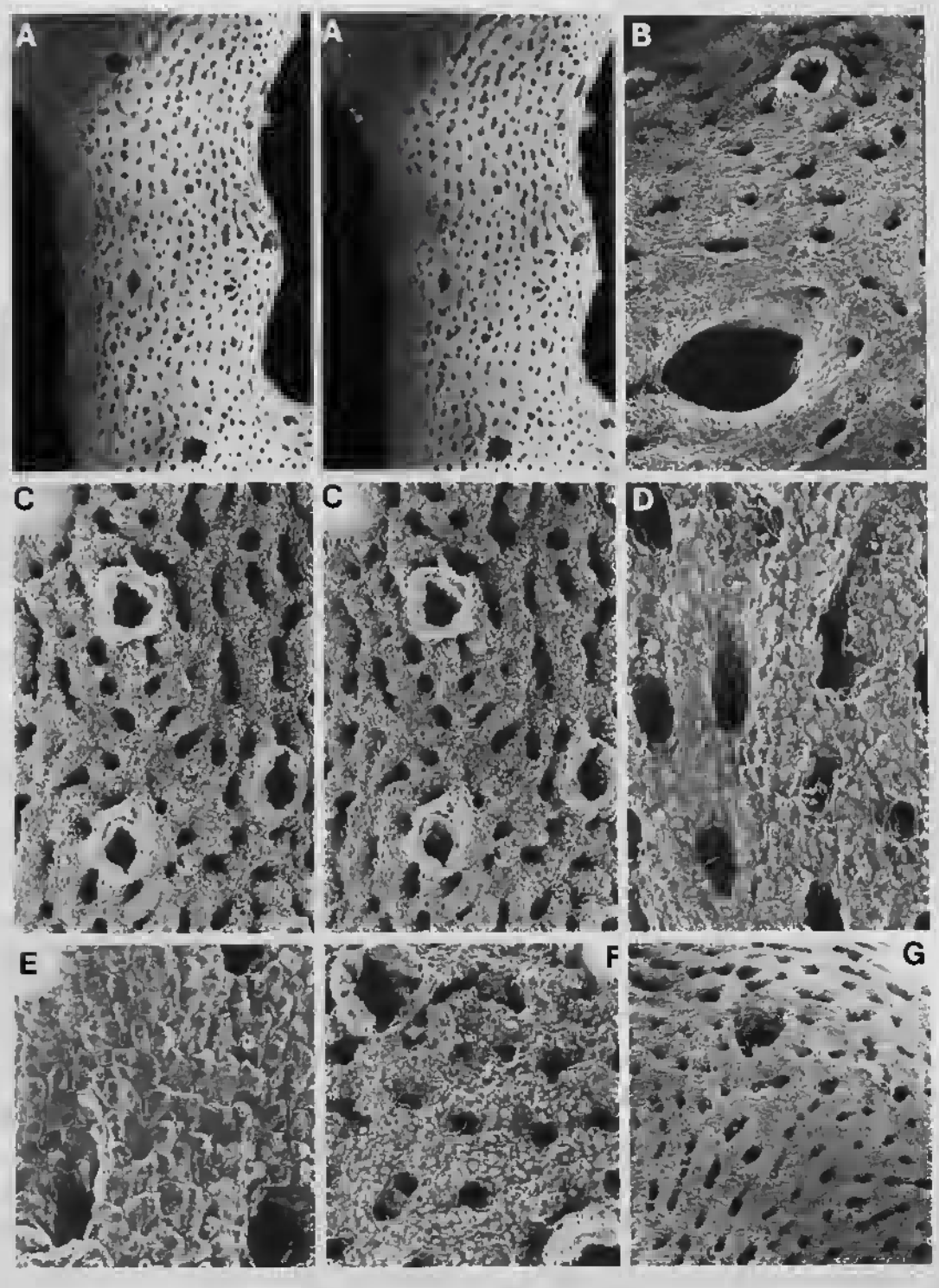

FIG. 8. — *Pliobothrus gracilis* (A-G, from " *Calypso* " 1959, drag. 6, female paratype, USNM 77118): A, branch face showing efferent pores of three female ampullae, no gastropores evident (× 18, stereo pair); B, oblique view of coenosteum illustrating elliptical gastropore and conical dactylopores (× 66); C, top view of coenosteum illustrating three dactylopores and coenosteal texture (× 61, stereo pair); D-E, coenosteal texture (× 143, × 235, respectively); F, granular coenosteum and two dactylopores (× 87); G, female ampulla with large apical efferent pore (× 40).

	E. aspera	*E. dabneyi*	*E. atlantica*
colony shape	uniplanar to slightly bushy	uniplanar	bushy, sparsely branched
branches: taper; distal branch diameter	gradual taper; 0.7 mm	abrupt taper; 0.6 mm	gradual taper; 0.9 mm
coenosteal texture	reticulate-granular but imbricate dactylopore spines	reticulate-granular	reticulate-granular
gastropore lip	absent	present	absent
gastrostyle shape	ridged H:W = 1.5-3.3	ridged H:W = 3.5	ridged H:W = 2.3-3.3
dactylopore spines: individuality; height, width	some clustering; up to 0.65 mm, 0.27 mm	individual; 0.13-0.15 mm, 0.15 mm	individual; 0.14-0.16 mm, 0.25-0.27 mm
male ampullae: position; efferent pore location	internal; one irregularly shaped efferent pore 30-40 µm in diameter	superficial; 1-3 apical efferent pores	primarily internal; one round efferent pore 50-60 µm in diameter
other diagnostic characters	many small dactylopores without associated spine	coenosteal papillae sometimes present, branch anastomosis occasionally	larger colonies with eunicid polychaete

Remarks

The specific name given to the new species refers to the slender form of the branches.

Previously, this form from Hyères Seamount had not been distinguished from the presumed widespread *P. symmetricus*.

Distribution and ecology

P. gracilis is known only from 2 stations on the slope of Hyères Seamount, depth 600-700 m. No symbionts are known.

Genus *ERRINA* Gray, 1835

Diagnosis. — Gastro- and dactylopores usually randomly arranged. Coenosteal texture reticulate-granular or linear-imbricate. Proximal gastropore lips common; gastrostyles present, having a moderate H:W ratio. Dactylopore spines U-shaped, with groove directed proximally; walls of dactylopore spines thick; no dactylostyles. Ampullae superficial.

Type species: *Millepora aspera* Linnaeus, 1767, from the Mediterranean.

Errina is represented in the study area by 3 species, including the type species.

Errina aspera (Linnaeus, 1767)

Fig. 9 A-I, 10 A-H

Synonymy:

Millepora aspera Linnaeus, 1767: 1283.
Errina aspera mascarina Boschma, 1965a: 3-6, text-fig. 1, pl. 1, fig. 1-4.

E. cochleata	*E. altispina*
uniplanar	uniplanar
abrupt taper; 0.3-0.7 mm	gradual taper; 0.4 mm
linear-imbricate, multiloculate platelets	linear-imbricate, broad platelets
present, prominent	present, prominent
not ridged H:W = 3.6	not ridged H:W = 4.9
individual; 0.10 mm, 0.10-0.13 mm	individual, two types of spines 1) 0.10 mm, 0.11 mm 2) 0.50 mm, 0.12 mm
* superficial; several apical efferent pores giving ampullae spiny aspect	* similar to that of *E. cochleata*
gastropores restricted to center of anterior face and branching axils	coenosteal papillae sometimes present

TABLE I. — Distinguishing characters of the five North Atlantic species of *Errina* (with new information on two species from the West Indies *)

Chresonymy:

Millepora aspera — ESPER, 1790: pl. 18, fig. 1-4; 1795: 106. — LAMARCK, 1816: 202. — RISSO, 1826: 347-348. — DARWIN, 1854: 477, pl. 19, fig. 5a. — ARADAS & BENOIT, 1876: 301.

Errina aspera — GRAY, 1835: 85. — DANA, 1848: 570-571. — SAVILLE KENT, 1871: 282-283. — MOSELEY, 1879: 479; 1881: 84. — CARUS, 1885: addendum. — FOL, 1885: 668-669. — BOSCHMA, 1953a: 32-33; 1953b: 301, etc.; 1954: 143, etc., pl. 1-3; 1956a: 283, 284, 286, 288; 1956b: F100; 1957a: 50-51; 1963a : 337, etc.; 1964f: 284; 1964g: 288; 1965b: 19; 1967: 329, 330, 331, 333. — ARNAUD & ZIBROWIUS, 1979: 123-124. — FREDJ & GIERMANN, 1982: 284-285, photo 1-8. — CAIRNS, 1983b: 428, 459-462, fig. 11A-G. — DI NATALE & MANGANO, 1985: 344. — GIACOBBE & LEONARDI, 1985. — DI GERONIMO & FREDJ, 1988: 243, pl. 1, fig. 1-4.

Errina aspera aspera — BOSCHMA, 1965a: 1-3, text-fig. 2, pl. 1, fig. 5-7.

Errina (*Labiopora*) aspera — HICKSON, 1912a: 888-889, pl. 95, fig. 6; 1912b: 462.

Errina aspera mascarina — VERVOORT & ZIBROWIUS, 1981: 29.

Hydrocoralliaire — PÉRÈS, 1964: 21.

NOT *Errina aspera* — VERRILL, 1864: 46 (Azores). — POURTALÈS, 1867: 116 (Azores).

NOT *Erina aspera* — BOSCHMA & LOWE, 1969: 15, pl. 5, map 2.

NOT *Errina* (*Eu-Errina*) aspera — BROCH, 1942: 40, fig. 10.

TYPES

Millepora aspera: In the original description, LINNAEUS (1767) characterized a structure which we now recognize as typical dactylopore spines (prominent outgrowths with slit-like pore on the lower side). This is a detail that he could not have found in the previous literature (MARSILI, 1725; GUALTERI, 1742) and proves that he had before him at least one authentic specimen. The type could not be found and is probably lost. HICKSON (1912a: 888) said that he examined " the type-specimen of this species [*aspera*] in the British Museum " on which GRAY (1835) founded the genus *Errina*. This simply means that he has seen the specimen previously studied by GRAY who made LINNAEUS' species the type of the genus *Errina*.

Type locality: Given by LINNAEUS (1767) as Mediterranean and Norwegian Sea. This should be restricted to Mediterranean. As pointed out by BOSCHMA (1953a, 1953b), the indication Norwegian Sea was due to a misunderstanding arising from a correspondence LINNAEUS had with GUNNERUS: referring to LINNAEUS, GUNNERUS (1768) added to his description of *Millepora norvegica* (as the name says, a species from Norway) that he considered this as being the same as LINNAEUS' *M. aspera*. In fact, these are distinct species (see account of *Stylaster norvegicus*).

Errina aspera mascarina: This subspecies is said to come from the Indian Ocean (Mauritius) and to differ from typical Mediterranean *E. aspera aspera*; it was described by BOSCHMA (1965a) from 2 slender colonies up to 37 mm high and 33 mm wide, one designated by him holotype, the other paratype, both at MNHN. Originally these colonies were attached to a telegraph cable (substrate not mentioned by BOSCHMA).

Type locality: Given by BOSCHMA (1965a) as Mauritius (Indian Ocean), from unrecorded depth. The origin, as indicated on the label found with the specimens (" *Spinipora*, île Maurice, 1883, échange VIMONT "), is certainly misleading. The 2 types look like slender Mediterranean material and closely resemble another slender colony of *E. aspera* at the MNHN that also had grown on a telegraph cable. The latter specimen (Fig. 9 B), found unidentified in the bryozoan collection, was labeled " Toulon – sur le cable transatl. ", meaning probably that it had been detached from a telegraph cable in the Mediterranean (or Straits of Gibraltar ?) and eventually landed at Toulon. Possibly the types of *E. aspera mascarina* and the " Toulon " specimen were collected together from the same cable.

MATERIAL STUDIED

Specimens of various sizes (colonies, branches, fragments) of *E. aspera* without exact collecting data are present in many museum collections (e.g. in coral collections, or together with *Pedicularia sicula* in mollusc collections): many colonies (MZUC). — 5 colonies already mentioned by BOSCHMA (1965a), Mediterranean or without indication (MNHN); types of *E. aspera mascarina* (MNHN); colony " Toulon – sur le cable transatl. " (MNHN); branch with *P. sicula*, Palermo (MNHN). — colony (MZUS). — Messina, H. FOL, colony (MHNG). — 2 colonies (NHMW 15714). — 2 branches with *P. sicula* (IRSNB IG 10591). — colony studied by BOSCHMA (1954) (ZMA Coel 7401). — branch with *P. sicula* (BMNH 1846.12.8.1) and several colonies, either Sicily or without locality (BMNH 1842.3.29.47/49, 1843.3.6.147/148/150).— 2 colonies (UZMC). — colony (ZMUO B 879). — photo (RMNH; by BOSCHMA) of colony in Manchester Museum mentioned by HICKSON (1912 a, as sent by J. MORGAN). — colony USNM 75602 (ex BMNH 1842.3.29.47). — Messina, branches with *P. sicula* (USNM 189433, 189435). — Sicily, branches with *P. sicula* (AMNH 14084, 14085). — fragment (YPM 5368).

Straits of Messina, more recently collected samples: G. FREDJ, 1964, colony (MNHN). — "*Bannock*" 1972, stn 23, off Punta Pezzo, 95 m, photo received from P. COLANTONI showing colony bearing *P. sicula*. — I. DI GERONIMO, 1986, several colonies from rocky bottom + many small colonies on fouled fishing line, ca. 100 m (MNHN; USNM 75603).

Straits of Gibraltar and approaches: Geological cruise, W.N. NESTEROFF (no details), small colony (MNHN). — " *Calypso* " 1958, stn SME-1282, several colonies + branches (most MNHN; USNM 59931). — " *Al Mounir* " stn B6-D6, B8-D2, dead colonies + branches (MNHN; USNM 48889). — " *Cryos* " 1984, cruise BALGIM stn DR-40, DR-49, DR-115, DR-116, dead branches + fragments (MNHN).

Atlantic coast of Morocco: " *Al Mounir* " stn B10-D3, several colonies + branches (most MNHN; USNM 48889; BMNH 1980.1.4.1).

Cape Verde Islands: " *Talisman* " drag. 114, 4 branches (MNHN) + fragment (BMNH 1950.1.11.94).

DESCRIPTION

Colonies primarily uniplanar but sometimes bushy (Fig. 9 A-B). Examined specimens up to 20 cm high and wide. Branches cylindrical, gradually tapering to pointed tips about 0.7 mm in diameter. Coenosteum white and porous. Coenosteal texture predominantly reticulate-

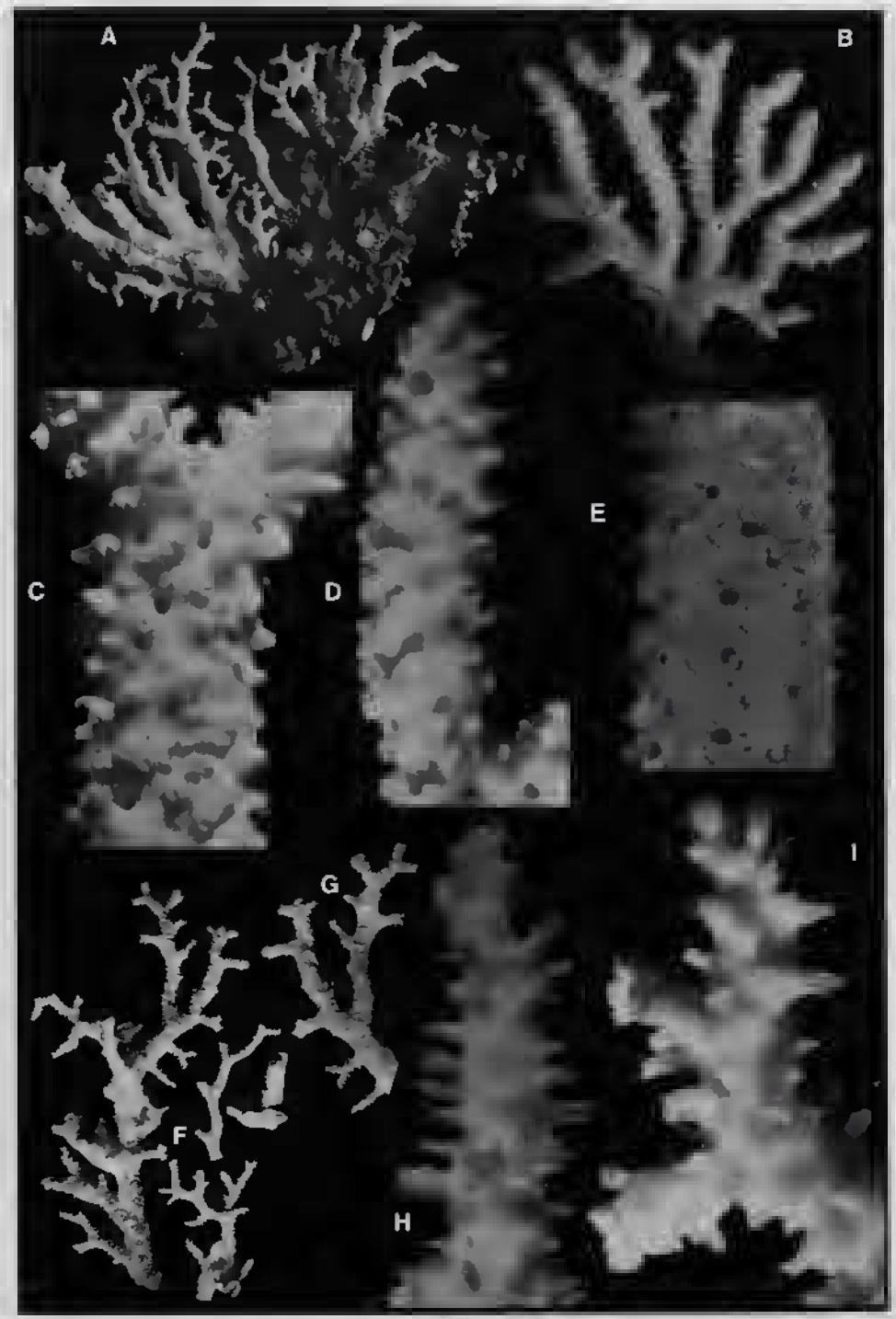

FIG. 9. — *Errina aspera* (A, from Messina, coll. H. FOL, MHNG; B, from unknown locality, "Toulon", MNHN; C-D, from "*Calypso*" 1958, SME-1282, MNHN; E, from "*Al Mounir*" B10-D3, USNM 48889; F-I, from "*Talisman*" drag. 114, F-H: MNHN, I: BMNH 1950.1.11.94): A, large colony (× 0.7); B, small slender colony very similar to types of *E. aspera mascarina* (× 1.8); C-E, details of branches showing dactylopore spines and gastropores with gastrostyles (all × 10); F, four branches and fragments (× 1.1); G, distal part, opposite face of larger branch under F showing two *Pedicularia* traces (× 1.1); H, tip of slender branchlet from larger branch under F (× 12); I, distal part of another branch (× 14).

granular (Fig. 10 E), but sides of dactylopore spines and inner gastropore tube surface usually imbricate (Fig. 10 F, H), a rare combination of coenosteal textures in one species. Coenosteal strips 45-75 µm wide; granules irregular in shape.

Gastropores circular, 0.18-0.25 mm in diameter, without proximal lip. Gastropore tube cylindrical, lacking a ring palisade. Gastrostyle occupies lower half of gastropore tube. Gastrostyle lanceolate: up to 0.27 mm tall and 0.09 mm in diameter, H:W ratios ranging from 1.5-3.3. Gastrostyles bear short, vertical ridges, which are covered by large pointed spines up to 26 µm long. Individualized dactylopore spines project perpendicularly from branch surface, predominantly with groove directed proximally (Fig. 9 C-E); however, some dactylopore spines directed obliquely, particularly when 2 or 3 are clustered. On distal branches dactylopore spines occur on all sides of branch but are rare on posterior face of larger basal branches. Dactylopore spines up to 0.65 mm tall; width, about 0.27 mm; width of dactylopore groove, 0.06-0.08 mm, or about one-quarter width of spine. Smaller slit-shaped dactylopores, unaccompanied by spines, are common, measuring 0.13-0.16 x 0.06 mm.

Female ampullae hemispherical, 0.5-0.7 mm in diameter, and often spinose as a result of short dactylopore spines. Female efferent pores about 0.11 mm in diameter, but were rarely observed. Male ampullae internal (Fig. 6 G), elliptical in shape, and about 0.4 mm in greater internal diameter. Each male ampulla communicates to surface by a narrow irregularly shaped efferent pore 30-40 µm in diameter (Fig. 10 E).

Comparisons

There are 17 valid Recent species of *Errina*, a genus known from the Atlantic, off South Africa, the Galápagos, and particularly from the New Zealand region, Subantarctic, and Antarctic (Cairns, 1983b, 1986a, 1986 b). The 5 Atlantic species are compared in Table 1. *E. aspera* is most similar to *E. atlantica* but can be distinguished by its taller dactylopore spines (which are imbricate in texture); the presence of numerous unspined dactylopores; and a tendency to be uniplanar in colony shape.

Remarks

E. aspera is recognizable in the brief original description of *Millepora aspera* by Linnaeus (1767), which certainly was based on material from the Mediterranean. Linnaeus also referred to Marsili (1725) and to Gualteri (1742), believing that his species had already been figured by these authors. However, as pointed out by Boschma (1953b), who analyzed and reproduced the pertinent passages and figures from all these older publications, Marsili's and Gualteri's illustrations are difficult to interpret, and bryozoans may be involved as well, at least in part.

The oldest known stylasterid from European seas, *E. aspera* has been the subject of considerable confusion. Confusion with the morphologically very different *Stylaster norvegicus* is explained above (see Types).

E. dabneyi (Pourtalès, 1871), from the Azores, had first been mentioned as *E. aspera* by Verrill (1864) and Pourtalès (1867) before it was described as a distinct species.

Boschma's (1965a) subspecies *mascarina* is discussed above (see Types).

E. aspera sensu Boschma & Lowe (1969) from Antarctica proved to be *E. gracilis* Marenzeller, 1903, as indicated by Cairns (1983a: 98, 100; 1983b: 459).

E. aspera sensu Broch (1942), said to come from the West Indies, was also misidentified. The small branch of slightly pink colour (SMNH 45) does not belong to either the Mediterranean – eastern Atlantic *E. aspera*, or to any species known from the West Indies (see Cairns, 1986a), but represents some other species, possibly of Antarctic or Subantarctic origin.

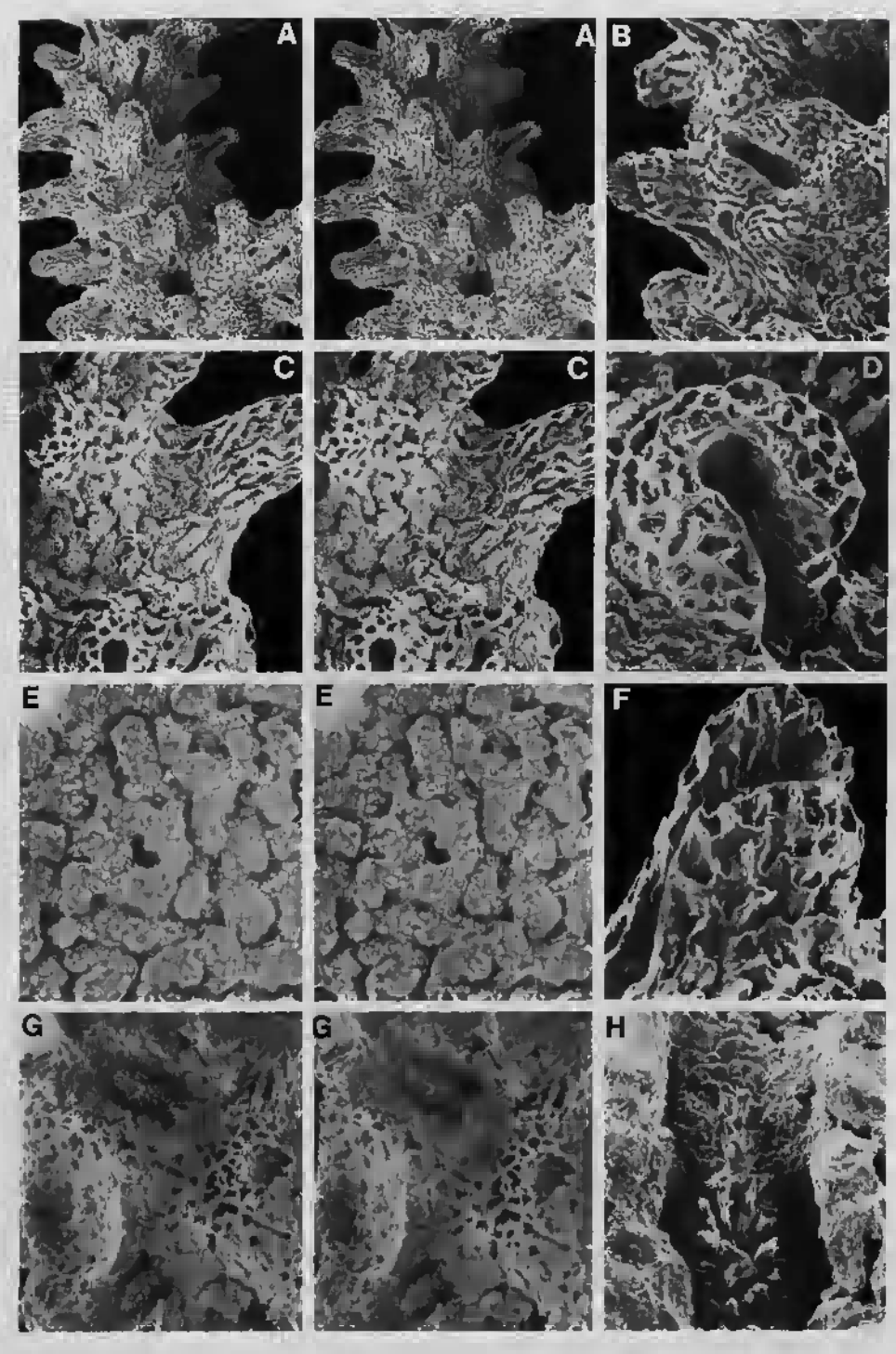

FIG. 10. — *Errina aspera* (A, C, H, from Straits of Messina, female, USNM 75603; B, D, F, from " *Calypso* " 1958, SME-1282, USNM 59931; E, G, from " *Al Mounir* " B10-D3, female, USNM 48889): A, branch segment illustrating a gastropore and numerous dactylopore spines (× 17, stereo pair); B, C, D, F, aspects of dactylopore spines and coenosteal texture (× 45, × 47, × 120, × 120, respectively, C being a stereo pair); E, coenosteal texture (× 120); G, transverse branch fracture revealing two gastrostyles and internal male ampullae (× 36); H, gastrostyle (× 140).

DISTRIBUTION AND ECOLOGY

As demonstrated above (see Types, Remarks), *E. aspera* has been reported by error from Norway, the Azores, the West Indies, Mauritius, and Antarctica.

The occurrence of typical *E. aspera* is confirmed only for the Straits of Messina, the Straits of Gibraltar with its Atlantic approaches, and a locality further south on the Atlantic coast of Morocco (33°43.5'N). A few branches from the Cape Verde Islands differ slightly from the typical Mediterranean form (see below).

In the Mediterranean the occurrence of *E. aspera* is sufficiently confirmed only for the Straits of Messina. ARADAS & BENOIT (1876) reported the associated gastropod *Pedicularia sicula* (on *Millepora aspera*) as frequently obtained there by the red coral fishermen. Abundant material of *Errina*, probably that examined by those authors, is present in the collection of the MZUC. FOL (1885), who observed the red coral fisheries aboard a boat from Messina, collected *Errina* and *Pedicularia* (MHNG). Thanks to the red coral fisheries once prosperous in and near the Straits of Messina, the fortuitously caught *E. aspera* and *Pedicularia sicula* are represented in many museum collections, generally with poor (if any) indications on the origin, such as Mediterranean, Sicily, or, at best, Messina.

Referring to observations from submersible dives, FREDJ & GIERMANN (1982) reported *E. aspera* to be very abundant on rocky bottom exposed to strong currents at depths of about 110-130 m in the straits between Ganzirri (Sicily) and Punta Pezzo (Calabria). In this part of the straits (off Punta Pezzo, 95 m) the hydrocoral with its gastropod symbiont has also been dredged by the " *Bannock* " in 1972 (photo communicated by P. COLANTONI; ARNAUD & ZIBROWIUS, 1979; SELLI *et al.*, 1980), and more recently by I. DI GERONIMO (material studied). The depth range of the species was extended by DI NATALE & MANGANO (1985) on the basis of sampling down to 181 m, and of a video-record from a submersible dive down to 236 m off Capo Annunciata, south of Messina (Sicily). The characteristic *E. aspera* hard bottom of the straits was again mentioned by GIACOBBE & LEONARDI (1985).

On the basis of dredgings and the previously mentioned submersible observations, DI GERONIMO & FREDJ (1988) summarized the depth distribution of *E. aspera* as being roughly 80-90 m to 200 m. They further pointed out that the stylasterid occurs together witb the large barnacle *Pachylasma giganteum* (Philippi, 1836), which also abounds and coexists with *E. aspera* in the Straits of Gibraltar on deep hard bottoms. Previously DARWIN (1854) had mentioned and illustrated the co-occurrence of both species (" Sicily, deep water ").

E. aspera has been recorded as a Plio-Pleistocene fossil from several localities in Sicily and Calabria (see Records of fossil stylasterids from Europe).

From various old collections and mainly old malacological literature (presence in the Mediterranean of *Pedicularia* implies that of its bost *E. aspera*) the following list of hypothetical *Errina* localities has been compiled: coast of North Africa, Alger, Maltese Islands, Palermo, Lipari or Eolian Islands, Capri, Nice area, Hyères, Toulon (the latter 3 localities on the coast of France). These indications do not prove the extended range of *E. aspera*; specimens may have been obtained there by naturalists from red coral fishermen or dealers, or the origin may be confused for otber reasons. It is particularly unlikely that the stylasterid (included by RISSO, 1826, in the fauna of the Nice area) occurs in the northern Mediterranean. It is more likely to be found along the coast of Nortb Africa since it also occurs in the Straits of Gibraltar.

Like the Straits of Messina, the Straits of Gibraltar is known for its hard bottom exposed to strong currents. Although few samples of *Errina* have yet been collected in the straits and its approaches (see Material studied) — the irregular and steep bottom is difficult to dredge — we can conclude that the stylasterid must be rather common there. In fact, shells of *Pedicularia* have been found abundantly (together with rare fragments of *Errina*) in coarse sediments under the Mediterranean outflow slightly west of the sill (" *Cryos* " 1984, cruise BALGIM). Apparently, the coral branches, when dead and detached, remain close to where they lived, whereas the lighter shells are sorted by the current and transported further away.

In the nearby Atlantic, *E. aspera* has been obtained from Spartel Bank, in the western approaches of the Straits of Gibralter (first mentioned by PÉRÈS, 1964, as " Hydrocoralliaire "), and from farther south on the coast of Morocco (33°43.5'N). *Pedicularia sicula* from that station had been reported independently by BELLON-HUMBERT & GOFAS (1977), who did not mention that it was an obligate symbiont of the stylasterid.

The occurrence of *E. aspera* in the Cape Verde Islands requires further confirmation. The few branches obtained there by the " *Talisman* " at the unusual depth of 600 m differ from typical Mediterranean E. aspera by their more spinous aspect, which we have interpreted as intraspecific variation (Fig. 9 F-I).

SYMBIONTS

Throughout its geographical range *E. aspera* is found with traces of *Pedicularia*. The symbiotic *P. sicula* has been obtained, either on live branches or as dead shells, from the sediment in the Straits of Messina, the Straits of Gibraltar and its western approaches (Spartel Bank), and further south on the Atlantic coast of Morocco (33°43.5'N). Only the traces of the symbiont are known from the Cape Verde Island material (Fig. 9 G).

In the Straits of Messina *P. sicula* is a common symbiont. Dead shells swept away by the currents have been obtained from the sediments at greater depths and at greater distances north and south of the sill (SELLI *et al.*, 1980): towards the Tyrrhenian Sea at 329 m off Scilla, and at 220 m towards the Ionian Sea off Villa San Giovanni.

Pedicularia is known as a fossil from the Lower Pleistocene of Sicily and Calabria (see Records of fossil stylasterids from Europe).

Errina dabneyi (Pourtalès, 1871)

Fig. 11 A-I, 12 A-F, 13 A-B

Synonymy:

Lepidopora dabneyi Pourtalès, 1871: 41, pl. 7, fig. 10-11.
Hornera verrucosa Calvet, 1903: 161-162, pl. 18, fig. 6a-c.
Errina amoena Boschma, 1956a: 281, text-fig. 1-3, pl. 1-2, pl. 3, fig. 1-4.

Chresonymy:

Errina aspera — VERRILL, 1864: 46. — POURTALÈS, 1867: 116.
Errina dabneyi — MOSELEY, 1879: 479; 1881: 84. — HICKSON, 1912a: 893 ; 1912b: 463-464, pl. 8, lower fig. — BOSCHMA, 1953b: 313, 314; 1954: 148; 1956a: 286-288; 1957a: 53; 1963a: 337; 1963c: 398, text-fig. 1-4, pl. 1, fig. 1-8; 1964f: 284-285; 1965a: 2; 1967: 331; 1968b: 113. — CAIRNS, 1983b: 428.
Errina dabneyae — BOSCHMA, 1953b: 313.
Errina (*Errina*) *dabneyi* — ZIBROWIUS, 1982: 981-982.
Hornera verrucosa — CALVET, 1931: 45. — BORG, 1944: 203. — BELLOC, 1960: 12.
Errina amoena — BOSCHMA, 1957a: 50; 1963a: 335.
Errina (*Errina*) *amoena* — VERVOORT & ZIBROWIUS, 1981: 26.
Errina spec. 2 — BOSCHMA, 1967: 330-331.

TYPES

Lepidopora dabneyi: In the original description, POURTALÈS (1871) mentioned several large colonies sent to the MCZ by Miss DABNEY (of the family of the American consul at Faial) that were obviously collected by local Azorean fishermen. No precise type status was given to the specimens by POURTALÈS. The type lot (here considered as syntypes) preserved at the MCZ comprises 3 large fan-shaped colonies 20-30 cm high and wide, and various smaller branches and minor fragments, at least in part broken off the larger colonies. Two fan-shaped branches from the type lot (the larger 58 mm high, 27 mm wide) were tranferred to the BMNH (1891.2.4.29). Some branches and fragments from the type lot are also at RMNH (Coel 13907) (Fig. 11 A) and USNM (75608).

Type locality: Faial, Azores. Upper bathyal depths (no depth indication in POURTALÈS, 1871; but remarks on *Caryophyllia cyathus* as epifauna permit this bathymetric extrapolation).

Hornera verrucosa: CALVET (1903) mentioned 4 colonies, all from one station, and figured one (29 mm high, 22 mm wide). No precise type status was given to these specimens, here considered as syntypes. Only part of the material mentioned was found at the MOM: 8 small fragments (possibly from a single branch or colony, but apparently not from the figured one), the largest about 20 mm high (Fig. 11 E).

Type locality: Prince of Monaco stn 247, 30.8.1888, 38°24'N, 28°01'25"W, 318 m. Azores.

Errina amoena: BOSCHMA's (1956a) original description was based on a single, large, fan-shaped colony (29.5 cm high, 31.5 cm wide) of which larger parts and smaller sectors have been figured. Being the only specimen mentioned, it must be considered as the bolotype, which is preserved at MNHN, together with some detached branches. Some smaller branches from the holotype at RMNH (Coel 15855) (Fig. 11 B) and USNM (75605).

Type locality: Given by BOSCHMA (1956a) as " China Sea, depth not recorded " based on old label found with type colony (" *Stylaster flabelliformis*, Mer de Chine, Mr. MONTIGNY "). In view of the otherwise confirmed distribution (*E. amoena* being a synonym of *E. dabneyi*), it is most likely that the indicated origin was wrong, as was the identification on the old label (*S. flabelliformis* being a large fan-shaped, morphologically convergent, species from the Mascarene Islands; see BOSCHMA, 1957b), and that the holotype of *E. amoena* came from the Atlantic.

MATERIAL STUDIED

Azores: Types of *Lepidopora dabneyi, Hornera verrucosa*, and *Errina amoena*. — Azores, SAVIGNY, 1843, 4 pieces of large fan-shaped colonies (ZMB 1066). — Origin not given but undoubtedly from local Azorean fisheries, large fan-shaped colony on piece of volcanic rock (MCM 63). — " *Talisman* " drag. 123, ca. 15 colonies, branches, fragments (MNHN); branch (figured by HICKSON, 1912b: pl. 8, lower fig.) + small branch (BMNH 1950.1.11.93; 1964.9.17.10). — " *Jean Charcot* " 1971, cruise BIAÇORES stn 49, 13 small branches + fragments (most MNHN; USNM 75606).

Mid-Atlantic Ridge: " *Bartlett* " 1975, stn 14, 4 branches (ZMUK).

DESCRIPTION

Colonies uniplanar, up to 30 cm high and wide; branches cylindrical and occasionally anastomose. Small diameter branches project perpendicularly from the larger diameter main branches. Distal branch tips about 0.60 mm in diameter. Coenosteum white and reticulate-granular in texture. Strips 55-100 µm wide, covered by rounded granules about 8 µm in diameter. Coenosteal papillae 63-100 µm in diameter and up to 0.15 mm tall sometimes occur on and adjacent to male ampullae (Fig. 11 G, 12 E). Papillae are assumed to contain additional nematocysts or a different type of nematocyst and therefore to serve a defensive function.

Gastropores circular, 0.15-0.20 mm in diameter, and bordered by a broad proximal lip. Gastropore tube cylindrical, lacking a ring palisade; gastrostyle occupies lower half of chamber. Gastrostyle lanceolate: illustrated style (Fig. 13 B) 0.31 mm high and 0.091 mm wide (H:W = 3.4). Gastrostyle strongly ridged, the ridges bearing pointed spines up to 27 µm long. Dactylopore spines individualized, almost exclusively with groove directed proximally, and occurring uniformly on all sides of distal branches but infrequently on larger diameter branches. Dactylopore spines also very common on undersides of gastropore lips (Fig. 12 C). Dactylopore spines short, projecting perpendicularly from branch surface up to 0.13-0.15 mm. Width of spine about 0.15 mm; width of groove 44-50 µm, or about one-third spine width. There are no unspined dactylopores.

Female ampullae (Fig. 12 F) hemispherical, 0.6-0.7 mm in diameter, with an efferent pore diameter of about 0.17 mm. Male ampullae (Fig. 12 E) smaller, slightly irregular protuberances, 0.4-0.5 mm in diameter, each with 1-3 small apical efferent pores.

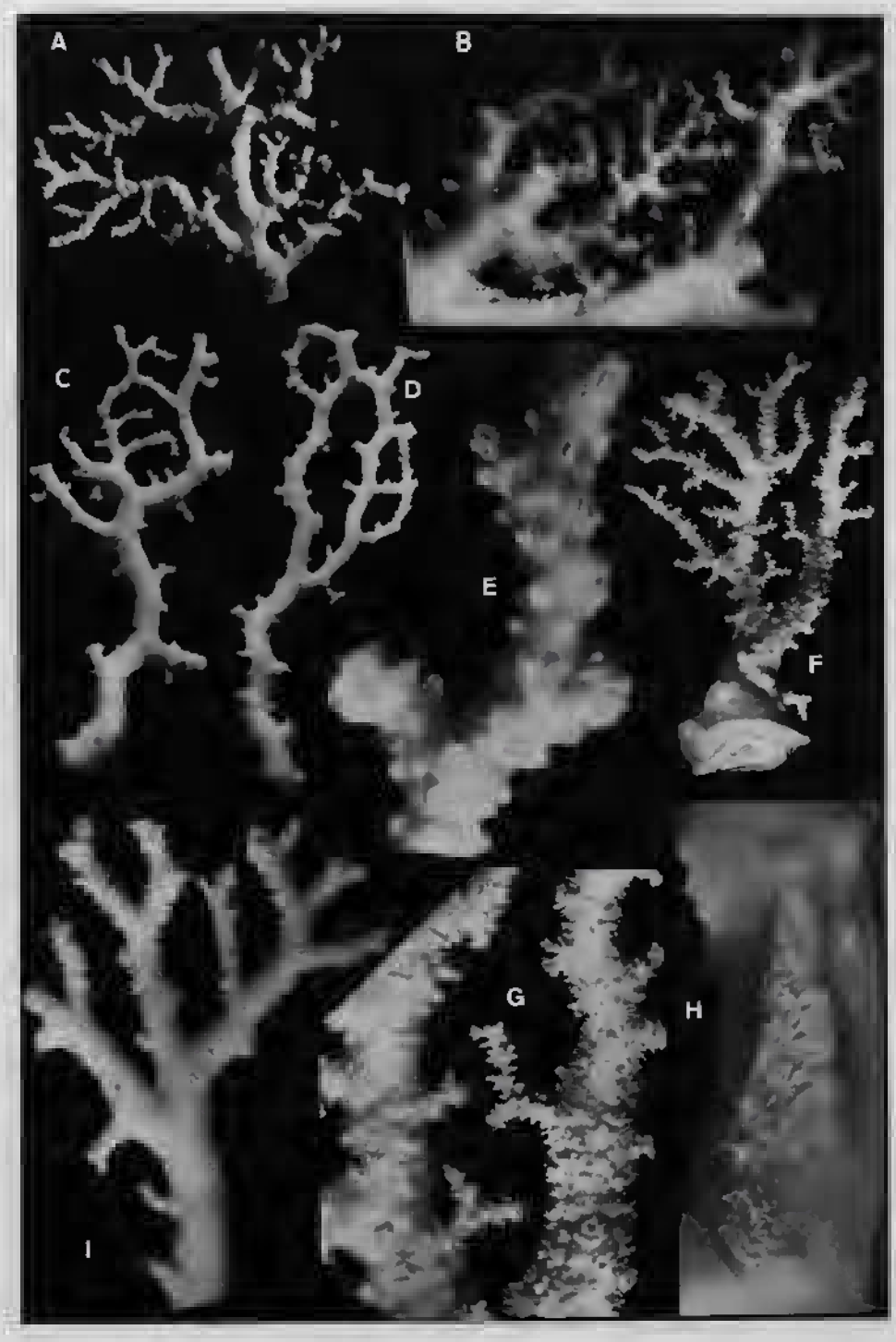

FIG. 11. — *Errina dabneyi* (A, syntype of *Lepidopora dabneyi*, RMNH Coel 13907; B, holotype of *Errina amoena*, RMNH Coel 15855 ; C-D, from " *Jean Charcot* " 1971, stn 49, MNHN; E, syntype of *Hornera verrucosa*, MOM; F-G, from " *Talisman* " drag. 123, MNHN; H, from " *Talisman* " drag. 123, BMNH 1950.1.11.93; I, from " *Bartlett* " 1975, stn 14, ZMUK): A, colony fragment (× 2.0); B, colony fragment (3.0); C-D, branches with anastomoses (both × 1.9); E, distal part of slender branchlet (× 15); F, colony having overgrown colony of *Pliobothrus* (× 1.5); G, detail of F showing abundance of coenosteal papillae (× 4.0); H, *Pedicularia* trace (× 13); I, branch with abundant coenosteal papillae (× 3.0).

Comparisons

Among the Atlantic *Errina*, *E. dabneyi* is clearly most similar to the western Atlantic *E. cochleata* Pourtalès, 1867 (Table 1) but can be distinguished by its ridged gastrostyles, reticulate-granular coenosteal texture, and occurrence of numerous dactylopore spines on the underside of each gastropore lip.

Remarks

Previous to its description as a distinct species, the type series of *E. dabneyi* had been referred to *E. aspera* (Linnaeus, 1767) by Verrill (1864) and Pourtalès (1867).

Pourtalès' (1871) original description of *E. dabneyi* (as *Lepidopora*) is very brief. A more detailed description, based on the types, was given by Boschma (1963c), who also mentioned this species in several other papers.

E. amoena Boschma, 1956, based on an old museum specimen said to come from the China Sea, proved to be identical with *E. dabneyi* (Boschma, 1963c, 1964f, 1968b). As for the unlikely disjunct distribution, we presume that the type of *E. amoena* was in fact of Atlantic origin and had been mislabeled.

Yet another synonym of *E. dabneyi* is *Hornera verrucosa* Calvet, 1903, described as a bryozoan from the Azores. Only much later Calvet (1931: 45-46) became aware that his *H. verrucosa* was a stylasterid hydrocoral. This rectification has been reiterated in the bryozoan literature by Borg (1944: 203) and Cook (1968: 238). The " transphyletic " synonymy of Calvet's (1903) bryozoan with Pourtalès' (1871) stylasterid was noted by Zibrowius (1982).

Hickson (1912b) tentatively referred specimens from the Azores (" *Talisman* ") to *E. dabneyi*, a species which at that time had not yet been illustrated, and of which he had not seen the types. Having seen these, Boschma (1963c, 1967) concluded that Hickson's identification of the " *Talisman* " material was incorrect, and that the form in question (*Errina* sp. 2 in Boschma, 1967) was more similar to *E. aspera* (Linnaeus, 1767). We have reexamined the 2 branches seen by Boschma, as well as additional material from the same station; we cannot follow his interpretation and refer the whole lot to *E. dabneyi*.

Distribution and ecology

E. dabneyi is known from the Azores (recorded depths of 3 stations ranging from 215-225 m to 500 m) and from the Mid-Atlantic Ridge southwest of the Azores (recorded depths of one station 140-2200 m).

For other samples the depth had not been recorded. According to Pourtalès (1871), *Caryophyllia cyathus* (Ellis & Solander, 1786) was growing on the thicker branches (type lot of *Lepidopora dabneyi*) received from Faial. In the Azores this scleractinian is common in depths of a few hundred meters (Zibrowius, 1980). Jourdan (1895: 10) also mentioned a specimen of *C. cyathus*, and Dautzenberg (1889: 39) specimens of *Pedicularia* taken from the same coral substrate (unidentified " polypier ") from off Faial, 400-500 m), and offered to the Prince of Monaco by W.S. Dabney in 1887. The coral substrate in question (no longer preserved either with *C. cyathus* or *Pedicularia* at the MOM) might well have been another colony of *E. dabneyi*.

To summarize, in the Azores *E. dabneyi* appears to be a species mainly of upper bathyal depths.

Symbionts

The characteristic traces of *Pedicularia* (Fig. 11 H) have been found on branches of most lots of *E. dabneyi* from the Azores (or presumably from the archipelago), including the types of *Lepidopora dabneyi*, *Hornera verrucosa*, and *Errina amoena*, and branches from " *Talisman* " drag. 123 and " *Jean Charcot* " 1971, cruise BIAÇORES stn 49. When examined in 1979, a large colony at the MCM (no. 63) still had several small *Pedicularia* attached.

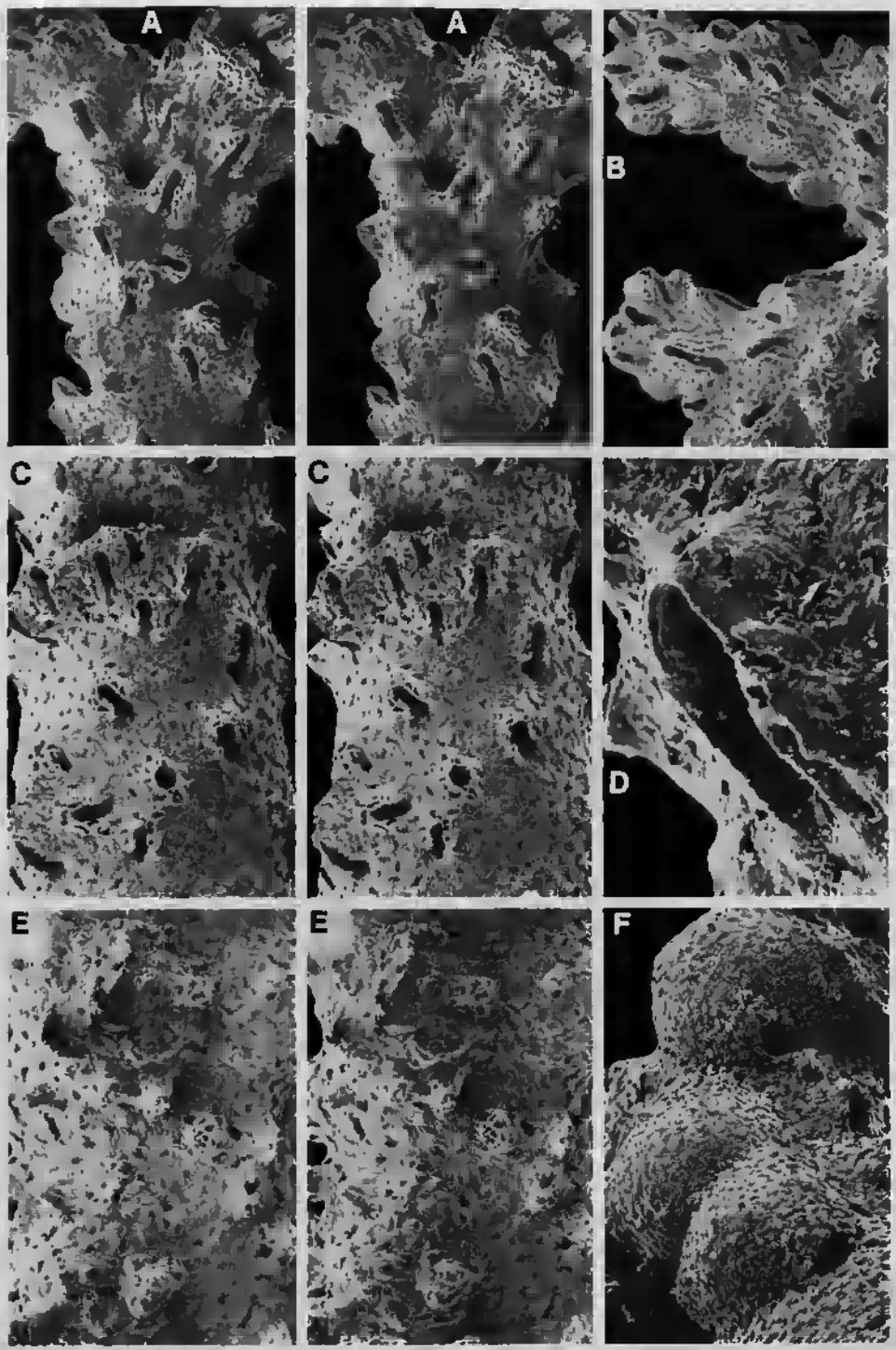

FIG. 12. — *Errina dabneyi* (A-B, holotype fragment of *Errina amoena*, USNM 75605; C, from "*Jean Charcot*" 1971, stn 49, female, USNM 75606; D, F, syntype of *Lepidopora dabneyi*, female, USNM 75608; E, from "*Talisman*" drag. 123, male): A, branch face illustrating gastro- and dactylopores (× 27, stereo pair); B, branch tips (× 26); C, branch face showing dactylopore spines and underside of proximal gastropore lip (× 38, stereo pair); D, dactylopore spines (× 158); E, male ampulla (× 38, stereo pair); F, female ampullae (× 32).

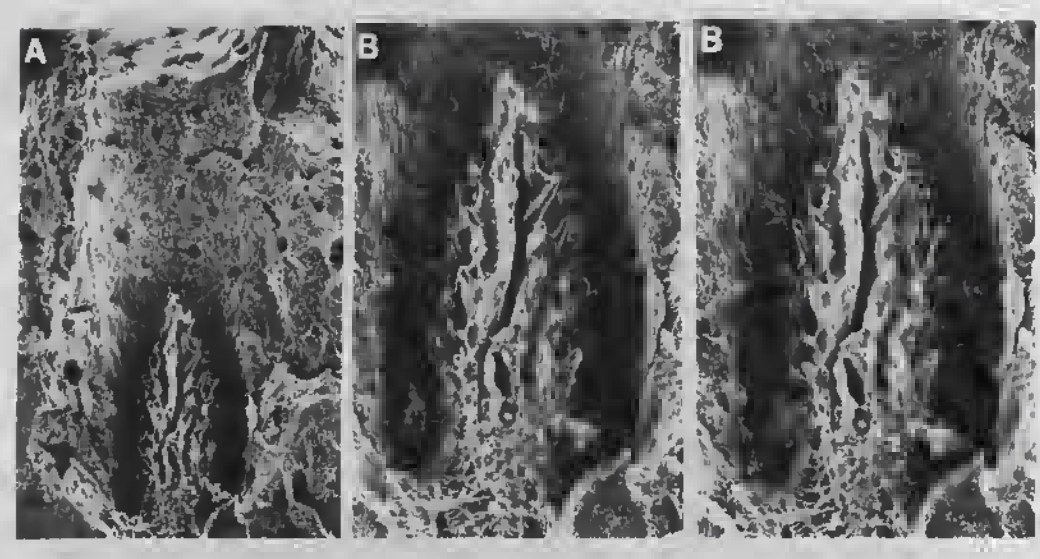

FIG. 13. — *Errina dabneyi* (A-B, from " *Jean Charcot* " 1971, stn 49, female, USNM 75606): A, gastrostyle and gastropore tube (× 91); B, gastrostyle (× 175, stereo pair).

Errina atlantica Hickson, 1912

Fig. 14 A-F, G-I ?, 15 A-G

Synonymy:

Errina atlantica Hickson, 1912b: 464-465.

Chresonymy:

Errina atlantica — BOSCHMA, 1957a: 52; 1967: 331-333, text-fig. 3a-b, pl. 1, fig. 7-10; 1968c: 206. — CAIRNS, 1983b: 428.

Errina (*Lepidopora*) *atlantica* — BOSCHMA, 1963a: 338-339; 1963b: 395; 1964a: 60-61.

TYPES

Errina atlantica: In the original description (HICKSON, 1912b), which was based on several branches from the Azores (" *Talisman* "), no specimens had been figured or otherwise individually characterised by size, or given a precise type status. Material identified by HICKSON as *E. atlantica* is present at the MNHN (various branches and fragments, including those figured by BOSCHMA, 1967: pl. 1, fig. 7-8), at the BMNH (1950.1.11.87, 1950.1.11.99, small branch and tiny fragment), and at the USNM (75609, fragment from BMNH 1950.1.11.87). When rediscovered in 1977, the largest pieces at the MNHN were branches 90 mm and 60 mm high, but have subsequently been accidentally broken into smaller pieces. The various old labels with these samples indicating dredge number, date, depth, and locality, are confusing and at variance with the official station list of the expedition. The greater part of the material certainly comes from " *Talisman* " drag. 128 (syntypes; Fig. 14 E), the remaining part possibly from drag. 127.

Type locality: Herewith designated as " *Talisman* " drag. 128, 16.8.1883, 38°07'N, 27°11'45"W, 983 m. Azores.

MATERIAL STUDIED

Azores: Origin not given but undoubtedly from the local Azorean fisheries, large colony (MCM 62). — " *Talisman* " drag. 127 (?), branch originally 90 mm high, now broken (MNHN); drag. 128, syntypes of *Errina atlantica* (see above). — " *Jean Charcot* " 1971, cruise BIAÇORES stn 197, several

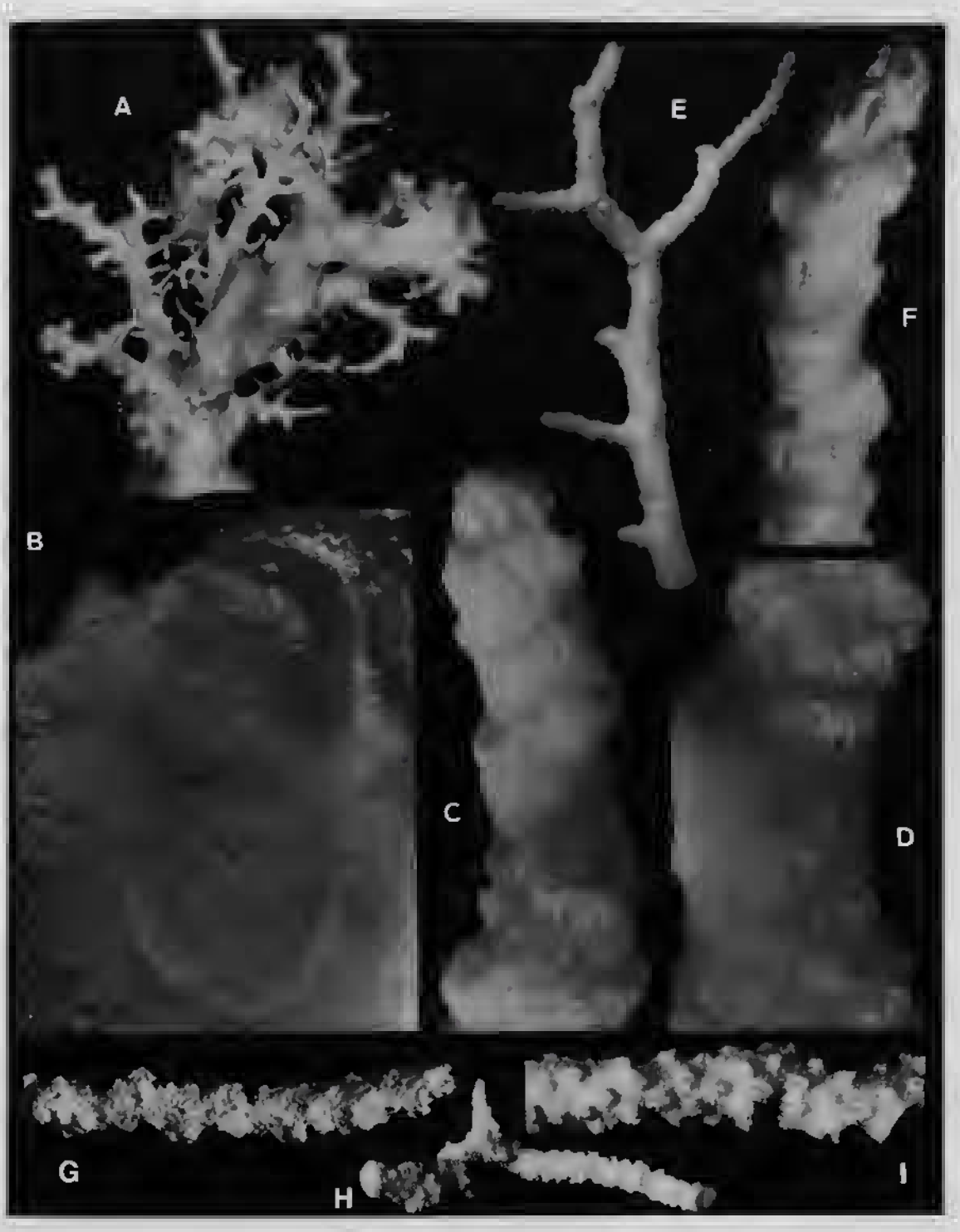

FIG. 14. — *Errina atlantica* (A-D, from " *Jean Charcot* " 1971, stat 240, MNHN; E-F, syntypes of *E. atlantica*, " *Talisman* " drag. 128, MNHN): A, bushy colony with incorporated tube of *Eunice norvegica* (× 0.8); B, *Pedicularia* trace (× 14); C-D, branch tip and branch segment illustrating gastro- and dactylopore arrangement (both × 18); E, branch with bulging ampullae (× 2.8); F, branch tip illustrating gastro- and dactylopore arrangement (× 8.6).

Errina atlantica ? (G, from " *Noroit* " DE-13, MNHN; H-I, from " *Noroit* " DW-21, MNHN): G, eroded branch (× 9.3); H, small incomplete colony (× 4.6); I, branch (× 11).

large pieces and many branches from at least one big colony (MNHN); stn 212, branch, dead (MNHN); stn 230, central piece of a colony, dead (MNHN); stn 240, several large pieces and many branches of several colonies (most MNHN; USNM 75610).

Gorringe Seamount: Material provisionally included here, identification uncertain (see Comparisons). "*Noroit*" 1987, cruise SEAMOUNT 1, stn DE-13, 11 fragments, dead (MNHN); stn DW-21, 5 fragments, including 1 live specimen (MNHN).

Description

Colonies bushy and sparsely branched (Fig. 14 A); largest pieces of colonies examined up to 12 cm high and wide, complete colonies apparently considerably larger. Branches cylindrical, gradually tapering to rather thick distal branches 0.8-1.0 mm in diameter. Coenosteum white, reticulate-granular in texture (Fig. 15 C-E). Strips 65-95 μm wide; granules 10-14 μm in diameter.

Gastropores circular, 0.22-0.30 mm in diameter, without a proximal lip. Gastropores occur predominantly on anterior face and lateral branch edges but not always in linear sequence as suggested by BOSCHMA (1967). Gastropore tube lacking ring palisade (Fig. 15 G). A slender, sharply pointed gastrostyle occupies lower 50-60 % of gastropore tube. Illustrated style (Fig. 15 G) 0.31 mm tall and 0.093 mm wide (exclusive of projecting spines) for a H:W ratio of 3.3. Two gastrostyles measured by BOSCHMA (1967: 332) had lower ratios of 2.3-2.6. Gastrostyle vertically ridged and spinose, as in the two previously described species. Dactylopore spines individualized, almost exclusively with groove directed proximally, and occurring primarily on the anterior face and lateral branch edges of distal branches and much less frequently on larger diameter branches. Dactylopore spines quite short, only about 0.14-0.16 mm tall on distal branches and virtually flush with coenosteal surface on larger diameter branches. Width of dactylopore spines 0.25-0.27 mm; width of groove 0.09-0.12 mm, or almost one half width of spine.

Female ampullae hemispherical (Fig. 15 B, F), about 0.70 mm in diameter with a lateral efferent pore about 0.20 mm in diameter. Male ampullae superficial on branch tips, becoming internal on larger diameter branches; mature ampullae about 0.5 mm in diameter, each with 1-3 apical efferent pores 50-60 μm in diameter.

Comparisons

As previously discussed, *E. atlantica* is most similar to *E. aspera* (see Table 1 and *E. aspera*, Comparisons).

Tiny pieces (18 mm maximum length and 1.4 mm maximum diameter) of *Errina* from Gorringe Seamount ("*Noroit*" 1987, cruise SEAMOUNT 1 stn DE-13, DE-21) are provisionally considered as a delicate form (young stages only ?) of *E. atlantica*. Available material consists of basal parts, unbranched colonies, branched fragments, and elongate straight terminal fragments (Fig. 14 G-I). Compared with Azorean material, the Gorringe specimens have slightly smaller dactylopore dimensions and gastropore diameter, and show no coenosteal luster (presumed to be eroded away). But some typical Azorean *E. atlantica* also have elongate, slender, nonbifurcating branches very similar to the Gorringe specimens.

Remarks

The original description of *E. atlantica* by HICKSON (1912b) was brief and not illustrated. This description was reproduced by BOSCHMA (1967), who also reexamined part of HICKSON's material and described some additional characters. Having seen original material, BOSCHMA (1967, 1968c) concluded that *E. atlantica* was a typical representative of *Errina* sensu stricto. In previous papers he had referred it, on the basis of HICKSON's description, to *Lepidopora*, then a subgenus of *Errina* but later elevated to generic rank by CAIRNS (1983b).

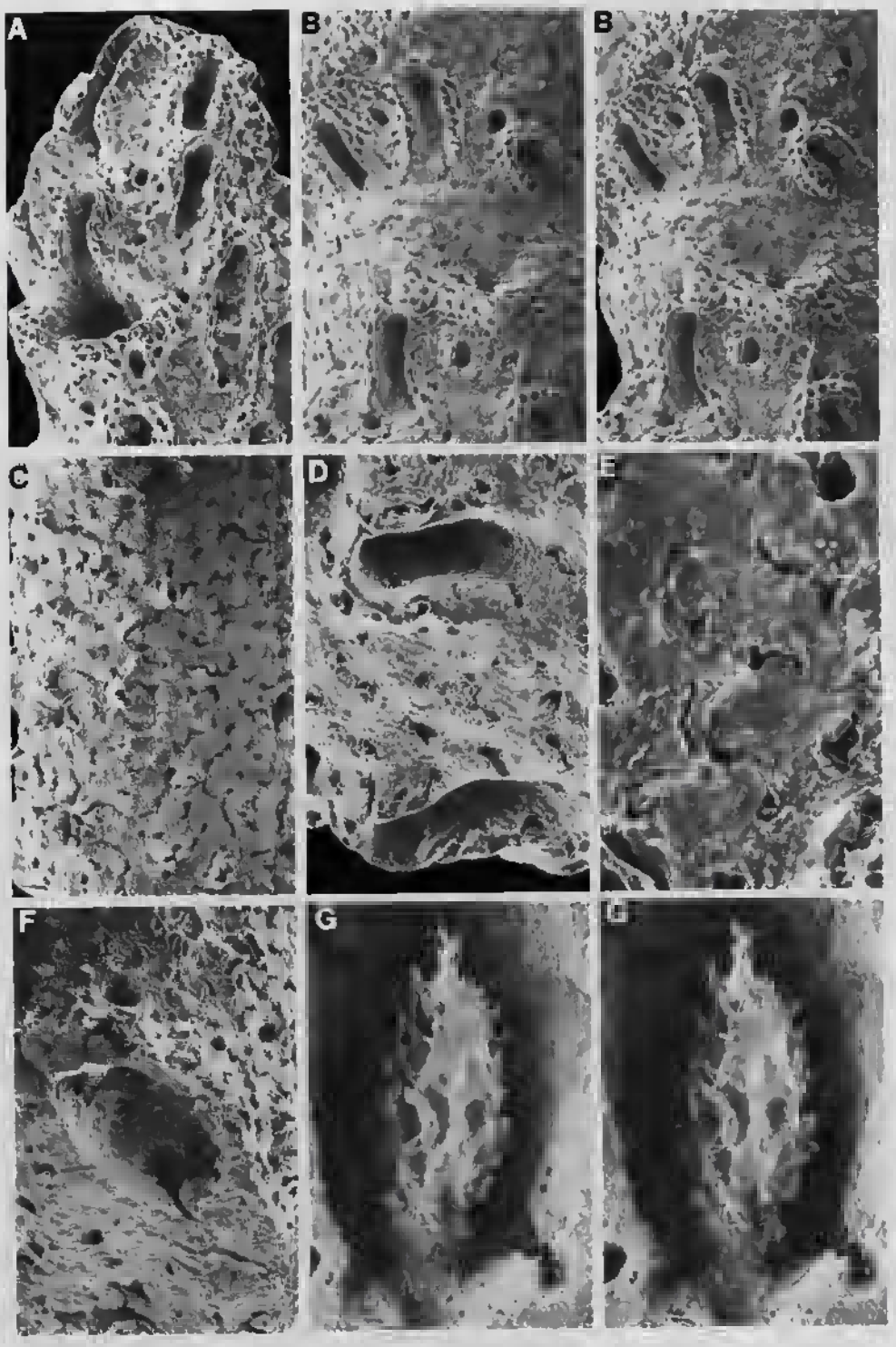

FIG. 15. — *Errina atlantica* (A-G, from "*Jean Charcot*" 1971, stn 240, female, USNM 75610): A, branch tip with gastropore and several dactylopore spines (× 37); B, female ampullae surrounded by four or five dacylopore spines (× 37, stereo pair) ; C, E, reticulate-granular branch coenosteum (× 35, × 165, respectively); D, two dactylopore spines (× 79); F, tranverse section of female ampulla (× 51); G, gastrostyle (× 158, stereo pair).

DISTRIBUTION AND ECOLOGY

E. atlantica is known from a few stations in the Azores. The depths of the 4 stations of " *Jean Charcot* " 1971, cruise BIAÇORES range between 610 m and 825 m; the depths of the type-locality is 983 m, if correctly recorded. Additional live material obtained by the " *Talisman* " possibly comes from a deeper station (1237 m).

Errina from two stations on Gorringe Seamount, off Portugal (460-480 m, 1110-1180 m), could be the same species.

SYMBIONTS

Larger colonies of *E. atlantica* from the Azores had *Eunice norvegica* (Linnaeus, 1767) as a symbiont (" *Jean Charcot* " 1971, cruise BIAÇORES stn 197, 230, 240; colony MCM 62). Covered by the coenosteum, the polychaete tube typically extends as an irregular hollow trunk through the greater part of the colony (Fig. 14 A).

Traces of *Pedicularia* (Fig. 14 B) have been found on branches of *E. atlantica* from the Azores, from several stations (colony MCM 62; " *Talisman* " drag. 128; " *Jean Charcot* " 1971, cruise BIAÇORES stn 197, 240). Rather large specimens of *Pedicularia* collected at stn 197 and 240 are likely to have been symbionts of *E. atlantica*, on which traces are correspondingly large; at stn 240 one large *Pedicularia* was found still on the coral in the collection.

Genus *STYLASTER* Gray, 1831

Diagnosis. — Gastro- and dactylopores arranged in cyclosystems. Cyclosystems variable in location, ranging from a uniform coverage of all branch surfaces (Group A) to a strictly sympodial arrangement (Group C), with many intermediate arrangements (Group B). Coenosteal colour and texture variable: most common textures reticulate-granular and linear-imbricate. Gastro- and dactylostyles present, the latter robust in Group A and moderate to rudimentary in Groups B and C. Gastrostyles usually ridged and bear long, pointed spines. Ring palisade often present; gastropore inner shelf sometimes present in Group C. Ampullae usually superficial, usually with distinct efferent pores.

Type species: *Madrepora rosea* (Pallas, 1766), from the western Atlantic (a member of Group B).

The 3 groups suggested by CAIRNS (1983b) are terms of convenience, not meant to imply taxonomic categories. CAIRNS (1983b) included *Allopora* Ehrenberg, 1834 (corresponding essentially to his Group A), as a synonym of *Stylaster*.

In the eastern Atlantic, *Stylaster* is represented by 3 species of Group A (*S. norvegicus, S. rosaceus,* and *S. blatteus*) and 3 species of Group B (*S. gemmascens, S. ibericus*, and *S. erubescens*, the latter with subspecies *groenlandicus* n. ssp., *britannicus* n. ssp., and *meteorensis* n. ssp.). *S. maroccanus* n. sp. is not assigned to a group because so little material was available.

Stylaster norvegicus (Gunnerus, 1768)

Fig. 16 A-G, 17 A-I

Synonymy:

Millepora norvegica Gunnerus, 1768: 64-67, pl. 2, fig. 20-22.
Stylaster (*Allopora*) *norvegicus* forma *atlantica* Broch, 1936: 49-52, text-fig. 14, pl. 7, fig. 20-21.
[?] *Allopora oculina* Ehrenberg, 1834: 147.

Chresonymy:

Allopora norvegica — SARS, 1873: 115-118. — STORM, 1882: 26. — HICKSON, 1890: 594. — NORMAN, 1893: 349. — BOSCHMA, 1956b: F100, fig. 80.5; 1957a: 24-26; 1962: 196-203, text-fig. 1d-e, 3a-i, pl. 2, fig. 1-4; 1964e: 109, 115.

Stylaster norvegicus — BROCH, 1914a: 15-19, text-fig. D, pl. 2, fig. 12-15, 18, pl. 3, fig. 23, 27, 31, pl. 4, fig. 35, 37-38, pl. 5, fig. 44-45. — NORDGAARD, 1915: 5. — CAIRNS, 1983b: 429; 1986a: 57.

Stylaster (*Allopora*) *norvegicus* — BROCH, 1928: 55, fig. 46c. — DONS, 1939: 197.

Allopora oculina — [?] MILNE EDWARDS & HAIME, 1850: 99, pl. 4, fig. 4; [?] 1857: 132. — DUNCAN, 1870: 290, 295 (part). — MOSELEY, 1879: 480; 1881: 85 (part: Norway).

Stylaster gemmascens — DUNCAN, 1873: 332 (part), pl. 49, fig. 1.

NOT *Stylaster* (*Allopora*) *norvegicus* — HICKSON, 1915: 544-545, pl. 1, fig. 3 (British Columbia). — BROCH, 1935: 59, fig. 2 (Okhotsk Sea).

NOT *Stylaster* (*Allopora*) *norvegicus forma pacifica* Broch, 1936: 52-54, text-fig. 15, pl. 6, fig. 18-19 (Okhotsk Sea, British Columbia)

NOT *Allopora norvegica pacifica* — FISHER, 1938: 522-524, pl. 53, fig. 2-2b, pl. 54, fig. 1, pl. 76, fig. 3-4 (Okhotsk Sea). — EGUCHI, 1941: 1181-1182 (Japan). — BOSCHMA, 1953a: 166, 170-171; 1957a: 26. — NAUMOV, 1960: 533, fig. 417, pl. 25, fig. 3 (Kurile Islands).

TYPES

Millepora norvegica: GUNNERUS' (1768) description was based on specimens from Norway. According to BROCH (1914a: 18), syntypes (number of specimens not given) are present at the VSM. One of these is figured by BROCH (1914a: pl. 2, fig. 12).

Type locality: GUNNERUS' specimens came from Nordmør, west coast of Norway.

Allopora oculina: EHRENBERG's (1834) description was based on a colony (herein considered to be the holotype) of unknown origin at the ZMB. This has been redescribed in more detail and figured by MILNE EDWARDS & HAIME (1850). The type could not be found in 1984, and may be lost.

Type locality: Unknown (probably Norway, see Remarks).

Stylaster (*Allopora*) *norvegicus* forma *atlantica*: the original rank of BROCH's (1936) forma *atlantica* (opposed to forma *pacifica*) was clearly meant to be that of a geographical subspecies. However, the North Atlantic subspecies being the nominotypical one, its name must be *S. norvegicus norvegicus*; accordingly, BROCH's naming of forma *atlantica* was an unnecessary taxonomic action.

MATERIAL STUDIED

Denmark Strait: "*Ingolf*" stn 52, colony (ZMUK). — "Poseidon" stn 12/1, ca. 450 branches + fragments, only one alive (SMF 6470; USNM 88824); stn 14/1, ca. 120 branches + fragments, dead (SMF 6473; USNM 88827).

Iceland or Faroes?: MÜLLER, 28.11.1900, colony (ZMUK).

Faroes: "*Dana*" stn 6009, small colony (ZMUK). — "*Anton Dohrn*" 18.11.1973, colony (IMFB). — "*Anton Dohrn*" 19.11.1973, branch (IMFB).

Between Faroes and Hebrides: "*Porcupine*" stn 54, 4 branches (BMNH 1880.11.13.4-5/8-9). — "*Triton*" stn 3, several big colonies + fragments (BMNH 1891.5.7.1, 1889.12.14.1, 1980.1.6.1).

Hebrides: off Butt of Lewis, June 1913, 2 colonies + fragments (RSM 1913.113.2).

Rockall: ca. 165 m, J. CORDEAUX (BMNH 1896.8.3.3-5; USNM 75620).

Norway: abundant samples in ZMUO and VSM, from many localities along the Norwegian coast, Senja, Steinavaer, Lofoten, Røst, Sklinna, Trondheimsfjord (including Agdenes, Brettingnes), Fjellvaerøy, Leksa, Kvalholmen/Hemna, Skredeness/ Sunndalsfjord, Bud, Aukra, Giske/Sunnmøre, Ålesund, Storegga (= Havbroen), Hardangerfjord, etc. — Normans Näsa, NW Storegga, 128-183 m, von YHLEN, colony (SMNH 28). — Storegga (= Havbroen), SARS, small colony (RSM 1884.37.158). — Rodberg, Trondheimsfjord, M. NORMAN, 1893, 1 fragment (BMNH 1922.2.2.6a). — Norwegian Sea, 2 colonies (RMNH Coel 15387). — "? N Atlantic", FRANK, 1897, 4 colonies + fragments (RMNH Coel 15388). — Agdenes, Trondheimsfjord, 60-80m, C. DONS, 23.6.1935, branches (RMNH Coel 15381). —

TABLE 2. — Comparisons of eastern A

	S. norvegicus	*S. rosaceus*	*S. blatteus*	*S. maroccanus*
cyclosystem orientation (group)	random (group A)	random (group A)	random (group A)	sympodial and ante face (group ambiguous)
dactylostyle	robust	rudimentary	rudimentary	rudimentary
coenosteal texture; colour	reticulate-granular but smooth; white to off white	reticulate-irregular granular; pink	reticulate-granular (granules irregular); purple	reticulate-granular; white
dactylopores per cyclosystem: range, mean, mode (N)	3-10, 6.33, 6 (500) 5-11, 6.92 7 (738)	5-12, 8.57, 9 (70)	6-12, 8.88, 9 (500)	9-14, 11.77, 11 (27)
cyclosystem shape and size	circular; 0.9-1.1 mm	circular to slightly elliptical; 0.6-0.7 mm	circular to slightly elliptical; 0.8-0.9 mm	circular to elliptical 1.0-1.4 mm
gastrostyle shape; ridges; H:W ratio	globular to conical; not ridged; 0.9-2.6	elongate-conical; ridged; 3.5	lanceolate; deeply ridged; 2.0-3.9	elongate cylindrical ridged; 5.5
ring palisade	absent	well-developed, elements cylindrical	well-developed, elements vertical carinae	well-developed, ele vertical carinae
ampullae: female, male	♀ unknown ♂ internal (0.5-0.6 mm)	♀ superficial (0.7 mm) ♂ unknown	♀ superficial (0.5-0.65 mm) ♂ superficial with apical efferent pores (0.3-0.45 mm)	♀ superficial (0.45 m 0.65 mm) ♂ unknown
distribution	Denmark Strait to Rockall and northern Norway, 75-1400 m	Gulf of Guinea: São Tomé, 37 m	Gulf of Guinea: São Tomé and Principe, 0-10 m	off Morocco (Atlan 1378 m
other diagnostic characters	branch tips robust	isolated dactylopores present; deep slits between coenosteal strips	isolated dactylopores very common; deep slits between coenosteal strips	colonies small and bushy; early sexual maturity

laster and *S. erubescens erubescens*

S. gemmascens	*S. ibericus*	*S. erubescens erubescens*	*S. erubescens groenlandicus*	*S. erubescens britannicus*	*S. erubescens meteorensis*
imarily on lateral anch edges but me on anterior and sterior branch es roup B)	primarily on lateral branch edges but some on anterior and posterior branch faces (group B)	primarily on lateral branch edges but some on anterior and posterior branch faces (group B)	primarily on lateral branch edges but some on anterior and posterior branch faces (group B)	primarily on lateral branch edges but some on anterior and posterior branch faces (group B)	primarily on lateral branch edges but some on anterior and posterior branch faces (group B)
dimentary	robust	robust	robust	robust	robust
ticulate-granular ough); hite to light yellow	reticulate granular but smooth; glistening white	reticulate-granular (granules irregular in shape); white	reticulate-granular (granules rounded); white	coarse granules (40-60 μm wide); wbite	reticulate-smooth (strips with numerous symmetrical lateral protuberances), unique; white
-17, 11.76, 12 (71)	4-11, 7.71, 8 (685)	7-15, 11.45, 11 (350)	5-14, 10.04, 10 (175)	7-12, 9.34, 9 (270)	9-15, 11.98, 11 (206)
rcular to quite egular; e.g. 3 mm, 1.6 mm × 7 mm	circular to sligbtly elliptical; 0.8-1.1 mm	circular to irregular; 1.3-1.7 mm	circular to slightly elliptical; 1.2-1.4 mm	circular to elliptical; 0.9-1.4 mm	circular to irregular; 0.9-1.2 mm
nceolate; not lged; 9-4.7	lanceolate, broadest at mid-heigbt; not ridged; 1.3-1.9	squat; not ridged; 0.8-1.4	lanceolate; not ridged but lateral tiers of spines; about 2	lanceolate; broadest at mid-height; not ridged; 1.7-2.0	ovate; unridged, very long spines; 1.1-1.3
ffuse, elements unded	absent	absent	absent	absent	absent
superficial .7-0.8 mm) superficial, carinate 65-0.75 mm)	♀ very low in relief (0.75-1.0 mm) ♂ internal (0.5 mm)	♀ superficial, often with efferent tube (1.0 mm) ♂ superficial, with apical efferent pores (0.6 mm)	♀ superficial, large, sometimes witb efferent tube, occasionally binary (1.0-1.3 mm) ♂ superficial lateral efferent pore (0.7-0.8 mm)	♀ superficial (1.1 mm) ♂ low, irregular mounds, apical efferent pore (0.6-0.7 mm)	♀ superficial, often with efferent tube (0.8 mm) ♂ superficial, apical efferent pores (0.6-0.7 mm)
nmark Strait to ckall and northern rway, 40-665 m	off NW Spain, 450-545 m	western Atlantic: off SE U.S.A, 146-530 m	off southern and eastern Greenland to Iceland, 326-713 m	off SE Iceland to Celtic Sea, 350-1080 m	seamounts soutb/ southwest of Azores, 293-500 m
enosteal papillae t ucommon, espe-lly on or near am-llae; cyclosystems red; efferent pore large	host of *Pedicularia*	colonies uniplanar, branches often thickened; host of *Pedicularia* and polynoid polychaete	colonies uniplanar, branches often thickened	colonies uniplanar, branches moderate in thickness; deep coenosteal slits on pseudosepta (Fig. 30 E); bost of *Pedicularia*	colonies bushy, branches slender

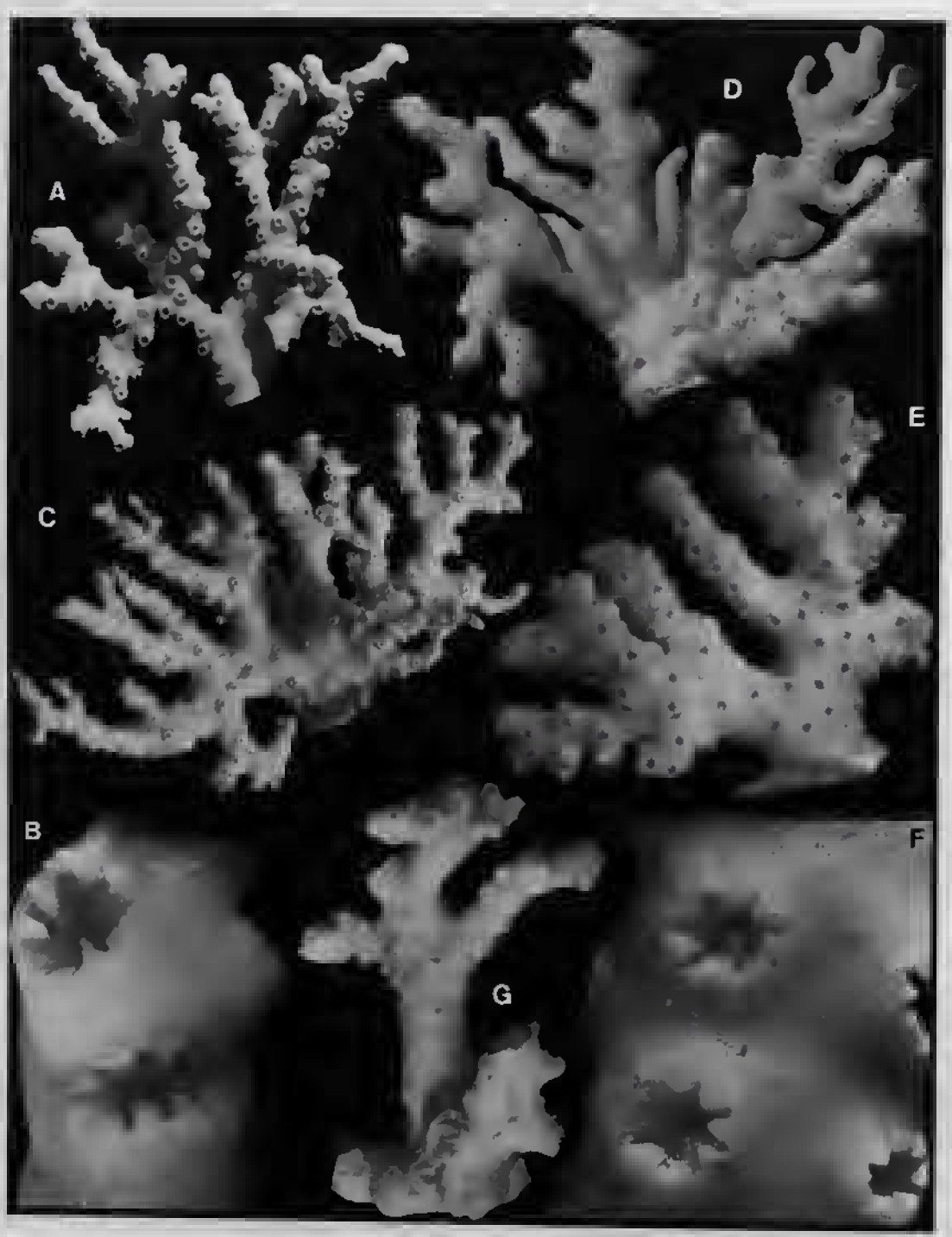

FIG. 16. — *Sylaster norvegicus* (A-B, from Trondheimsfjord, no further details, VSM; C, from Trondheimsfjord, Brettingnes, 100-300 m, coll. C. DONS 4.5.1939, VSM; D, from Hebrides, RSM 1913.113.2; E-F, from Lofoten, Røst, Kunstmaler ESAISSEN, VSM; G, from "*Porcupine*" stn 54, BMNH 1880.11.12.4-5): A, slightly bushy colony with rather slender cylindrical branches (× 1.5); B, blunt branch tip of A with cyclosystems (× 17); C, larger colony with branches becoming flattened near the base (× 1.0); D, larger uniplanar colony with branches flattened and coalescent near the base (× 1.0); E, colony with blunt branches in uniplanar arrangement (× 2.1); F, branch segment of E, gastrostyles visible in depth of cyclosystems (× 17); G, colony of irregular shape (× 2.1).

Norway, colony received from HICKSON (MNHN). — Norway, colony (NHMW 7970). — Norway, fragment received from G.O. SARS (USNM 6854, erroneously labelled as cotype). — "*Anton Dohrn*" 10.3.1972, large colony at IMFB known only from photograph.

DESCRIPTION

Colonies mostly uniplanar, up to 10 cm high and 15 cm wide (Fig. 16 A, C-D, F). Branches cylindrical and robust, 2-3 mm in diameter at blunt distal tips. Coenosteum white to off-white and smooth, a result of a reticulate-granular texture with very low relief granules. Figure 17 F shows a transition from an early stage of coenosteal development characterized by irregularly shaped granules to the more advanced, smooth stage in which the granules are united into strips and covered with a smooth coenosteum. Coenosteal strips 45-75 µm wide. Cyclosystems circular, 0.9-1.1 mm in diameter, occurring with equal frequency on all branch faces. Cyclosystems flush with coeosteum or raised only slightly above coenosteum. According to BOSCHMA's (1962) analysis of 500 cyclosystems, there is a range of 3-10 dactylopores per cyclosystem, mean 6.33, and mode 6. Our analysis of 738 cyclosystems revealed a slightly higher number of dactylopores per cyclosystems: range 5-11, mean 6.92, and mode 7. There are no diastemas.

Gastropore tubes 0.7-2.2 mm long, slightly constricted at level of gastrostyle tip; no ring palisade (Fig. 17 G). Gastrostyle (Fig. 16 F) occupies a variable percentage of gastropore tube, depending on height of style and length of tube (see BOSCHMA, 1962: fig. 3). Gastrostyle variable in shape, ranging from rotund (wider than high) to conical, with H:W ratios ranging from 0.9-2.6. Tallest known gastrostyle 0.75 mm; widest, 0.52 mm (BOSCHMA, 1962). Gastrostyles covered by extremely long, cylindrical, blunt spines up to 110 µm long and 15 µm in diameter, which are sometimes laterally fused into tiers (Fig. 17 H). Ridging of gastrostyle, if present, obscured by tall and abundant gastrostyle spines. Dactylotomes 0.10-0.15 mm wide. Dactylostyles (Fig. 17 C) robust, composed of blunt cylindrical elements much like gastrostyle spines, each element up to 75 µm tall and about 11 µm in diameter. Dactylostyles up to 0.6 mm long and 65 µm wide (4 or 5 elements across width), terminating about 0.2 mm from the tip of dactylopore.

Ampullae (male?) internal to slightly superficial (Fig. 17 E), 0.5-0.6 mm in internal diameter. Efferent pores round, about 0.13 mm in diameter. Female ampullae unknown.

COMPARISONS

S. norvegicus is easily distinguished from the other two eastern Atlantic species of *Stylaster* (Group A), by a large number of characters (Table 2). Within the Atlantic, it is most similar to *S. miniatus* (Pourtalès, 1868), known from off the southeast coast of the United States from 146-530 m (CAIRNS, 1986a). Points of similarity include: cyclosystem diameter, gastrostyle ornamentation and H:W ratio, dactylostyle shape, and characteristics of the male ampullae. Nonetheless, *S. norvegicus* can be distinguished by its coenosteal texture and higher number of dactylopores per cyclosystem.

REMARKS

S. norvegicus is recognizable in GUNNERUS' (1768) illustrated description from Norway (as *Millepora*). BROCH (1918) commented upon this description and reproduced some of the figures. Referring to a correspondence he had with LINNAEUS, GUNNERUS (1768: 67) added the erroneous remark that his *Millepora norvegica* was the same as *Millepora aspera* Linnaeus, 1767 (for which the distribution had been given as Mediterranean and Norwegian Sea). This was a misunderstanding (BOSCHMA, 1953a, 1953b, 1965a); in fact, LINNAEUS' coral (now known as *Errina aspera*) is a Mediterranean species and does not occur along the coast of Norway.

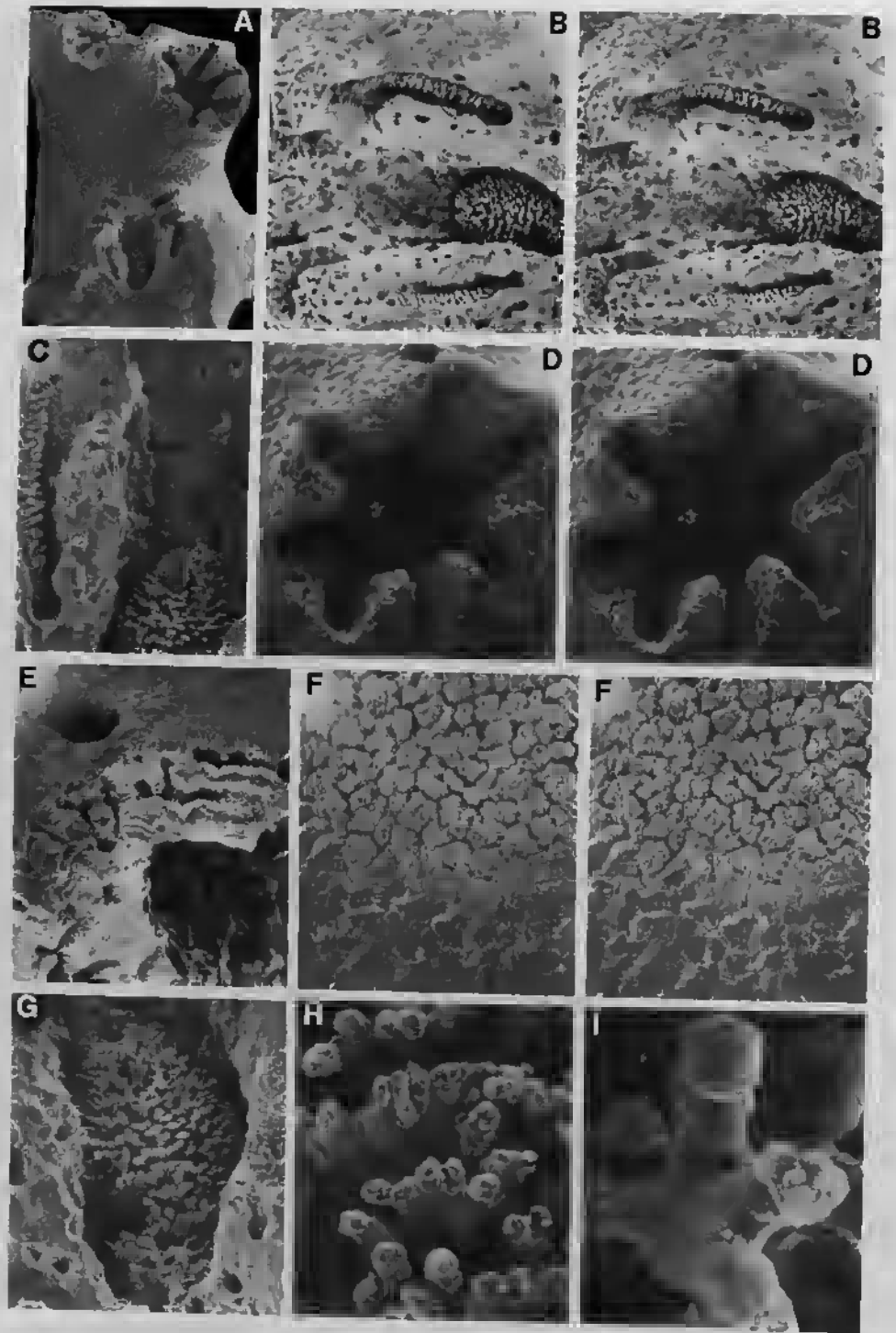

FIG. 17. — *Stylaster norvegicus* (A-D, F-I, from Norway, USNM 6854; E, from Rockall, male, BMNH 1896.8.3.3-5): A, branch fragment illustrating two cyclosystems, one of them longitudinally fractured (× 13); B, longitudinally fractured cyclosystem illustrating gastrostyle and dactylostyles (× 32, stereo pair); C, tip of gastrostyle and dactylostyle (× 60); D, cyclosystem (× 42, stereo pair); E, fracture through internal male ampulla, efferent pore at coenosteal surface (× 65); F, transitional coenosteal texture (× 85, stereo pair); G, gastrostyle (× 81); H-I, transversely fused gastrostyle spines (× 300, × 1560, respectively).

BROCH (1936) erroneously included *Allopora miniata* Pourtalès, 1868, in the synonymy of *S. norvegicus*. As BOSCHMA (1962) had already argued, BROCH's reference specimens were not authentic western Atlantic *A. miniata*, but mislabeled northeastern Atlantic *S. norvegicus*; in fact, BROCH had not seen the single authentic small branch of *A. miniata* in the ZMUO. Typical *A. miniata* (redescribed by CAIRNS, 1986a, as *Stylaster miniatus*) differs from *S. norvegicus* in various aspects, such as surface structure, depth of gastropores, higher number of dactylopores (see Comparisons).

Allopora oculina Ehrenberg, 1834, of unknown origin, is most likely a synonym of *S. norvegicus*. The original description and a redescription by MILNE EDWARDS & HAIME (1850) may apply to the Norwegian stylasterid, which was easily available to the older authors. *A. oculina*, as repeatedly reported from Norway in the 19th century, should be referred to *Stylaster norvegicus*. *A. oculina* sensu STUDER (1878), from South Africa (ZMB 1654), is very different, close to *Stylaster bithalamus* Broch, 1936.

The first adequate description of *S. norvegicus*, according to modern standards, was given by BROCH (1914a) from Norwegian and other northern Atlantic material (including GUNNERUS' types). Norwegian material was again analyzed in detail by BROCH (1936) and BOSCHMA (1962).

S. norvegicus, often attributed to the genus *Allopora*, is mentioned in various publications on the fauna of Norway, where *S. norvegicus* and *S. gemmascens* frequently occur together but have not always been distinguished; many lots in museum collections under one or the other name have proved to be a mixture of both species.

S. norvegicus is one of four species reported by DUNCAN from between the Faroes and the Hebrides, first (1870) as *Allopora oculina*, then (1873) as *Stylaster gemmascens* (the other species are *S. gemmascens*, *S. erubescens britannicus*, and *Stenohelia maderensis*).

Stylasterids from the northern Pacific (Japan to British Columbia) have occasionally been referred to *Stylaster* (or *Allopora*) *norvegicus*, mostly as a distinct forma or subspecies *pacifica* as opposed to *atlantica* (HICKSON, 1915; BROCH, 1935, 1936; FISHER, 1938; EGUCHI, 1941; NAUMOV, 1960). One of these records (British Columbia) was subsequently reidentified as *Stylaster verrillii* Dall, 1884 (FISHER, 1938: 524; BROCH, 1942: 6). Likewise, CAIRNS (1983b: 429) tentatively included *Allopora norvegica pacifica* Broch, 1936, in the synonymy of *S. verrillii*.

DISTRIBUTION AND ECOLOGY

S. norvegicus is known from many stations in a wide area of the North Atlantic: from Denmark Strait, the northwest, southwest, and southeast of Iceland, Faroes and Hebrides, Rockall, and along the coast of Norway. Its occurrence in Icelandic waters, already reported by BROCH (1914a), is here confirmed. The northernmost records are 66°18'N in Denmark Strait, and 69°14'N off Norway.

In Norway the species is common in depths of 80-300 m, frequently found together with the bank-forming scleractinian *Lophelia pertusa*. Elsewhere, the shallowest record is from 75 m in the Faroes. In the Iceland – Faroes area the species has been obtained as deep as 1040 m and 1400 m.

No symbionts are known.

Stylaster rosaceus (Greeff, 1886)

Fig. 18 A-H

Synonymy:

Allopora rosacea Greeff, 1886: 19-20.

Chresonymy:

Allopora rosacea — BROCH, 1914b: 38-40, text-fig. 12, pl.1, fig.4-5. — BOSCHMA, 1957a: 27; 1961: 219-220.
Stylaster rosaceus — CAIRNS, 1983b: 429.

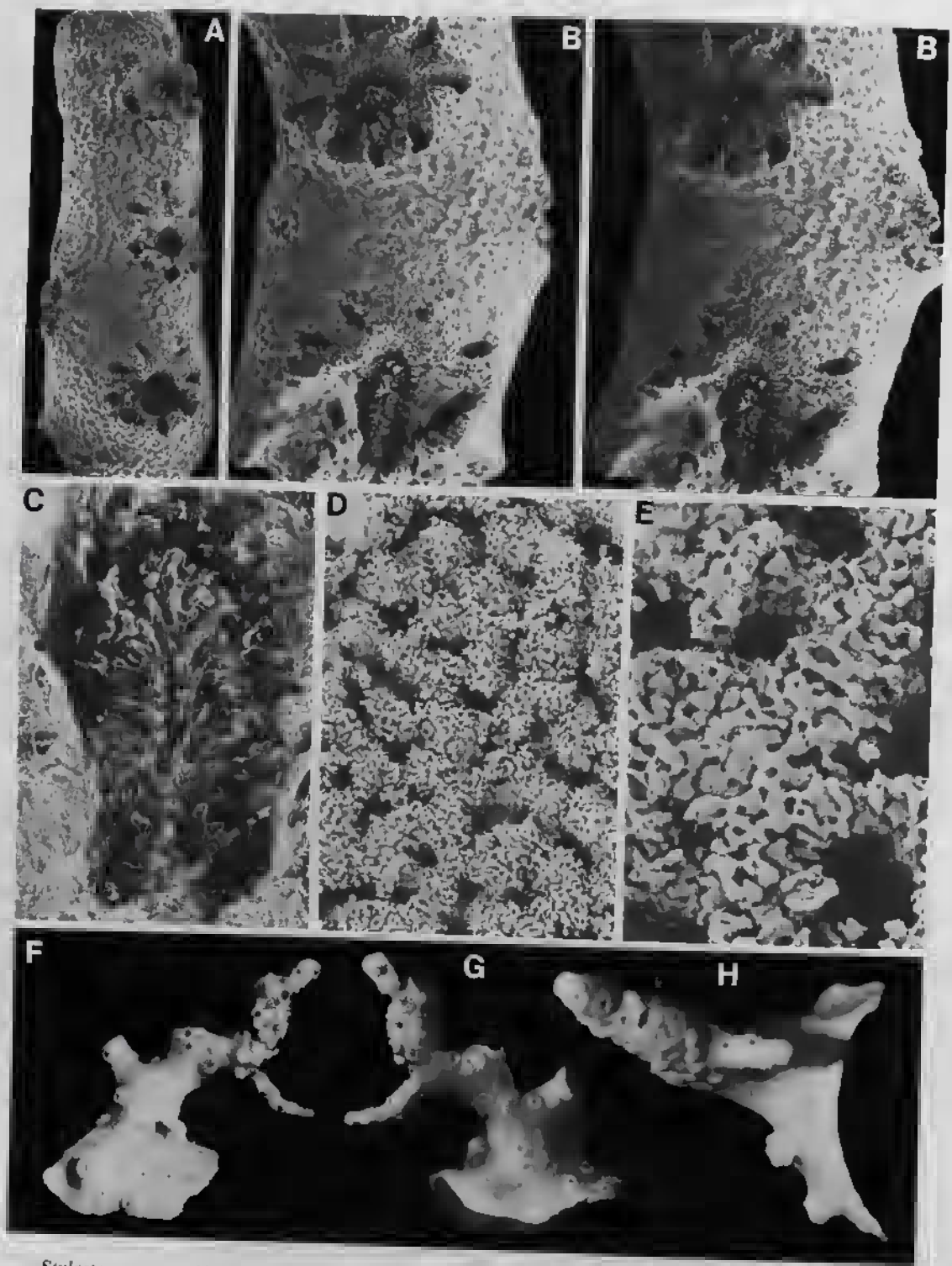

FIG. 18. — *Stylaster rosaceus* (A-H, female syntype, ZMB 4725): A, branch fragment bearing three cyclosystems (× 24); B, branch segment bearing two cyclosystems, lowermost fractured revealing gastrostyle (× 36, stereo pair); C, gastrostyle and ring palisade (× 142); D-E, coenosteal texture (× 128, × 359, respectively); F-G, opposite faces of colony, one with clustered female ampullae (both × 3.5); H, edge view of colony (× 5.3).

Types

Allopora rosacea: In the original unillustrated description, Greeff (1886) mentioned several small colonies up to 35 mm high. Having not been given a precise type status, they are considered as syntypes. After Greeff's death at least part of his collections were transferred from the Zoological Institute, Marburg, to the Zoological Museum, Hamburg, where Broch (1914b) was able to study one of the syntypes. This specimen was lost when the museum burnt in 1943. Another smaller female syntype (12 mm tall, 13 mm broad) exists at the ZMB (4725), probably deposited there by Greeff himself. This is the only specimen known to be preserved (Fig. 18 F-H).

Type locality: Passage between São Tomé and Ilha das Rolas, Gulf of Guinea, depth ca. 37 m (R. Greeff, 1880, dredge).

Material studied

São Tomé: 1 syntype (ZMB 4725).

Description

The only specimen available (Fig. 18 F-H) is a slender incomplete colony (most branch tips broken), 12 mm tall, uniplanar, with a thin encrusting concave base about 8 mm wide, the latter originally encrusting a cylindrical substrate. On the same base, next to the main stem, two smaller branches are broken away. Branches cylindrical, gradually tapering to slender branch tips the diameter of a cyclosystem. Coenosteum pink, mature (female) ampullae less pigmented to whitish; branch tips may also be of lighter colour. Coenosteum reticulate, strips 55-80 µm wide, but not granular, rather covered with irregularly shaped elongate carinae about 30 µm long and 7 µm wide (Fig. 18 D-E).

Cyclosystems occur on all branch surfaces; they are circular to slightly elliptical, 0.6-0.7 mm in diameter, almost flush with coenosteum. No diastemas observed. Based on 70 cyclosystems from encrusting base and branches, the range is 5-12 dactylopores per cyclosystem, mean 8.57, and mode 9.

Gastropore about 0.2 mm in diameter, with a robust ring palisade (Fig. 18 C) composed of cylindrical elements about 25 µm in height and diameter, not vertical carinae. Gastrostyles elongate-conical (Fig. 18 C), about 0.35 mm tall and 0.10 mm in diameter (H:W = 3.6), occupying basal half of gastropore tube. Gastrostyles vertically ridged, each ridge bearing slender elongate spines up to 41 µm long and 8 µm in diameter. Dactylotomes about 70 µm wide, separated by low pseudosepta 1-1.5 times width of dactylotomes; no diastemas. Dactylotomes open apically, rarely directly into gastropore chamber. Isolated dactylopores present but sparse. Dactylostyles not examined.

Female ampullae superficial hemispheres about 0.70 mm in diameter, clustered on both anterior and posterior faces. Efferent pore about 0.15 mm in diameter. Male ampullae unknown.

Comparisons

Based on the single preserved syntype, *S. rosaceus* differs from the better known sympatric *S. blatteus* in the following characters: colour pink versus purple; slender branches; smaller cyclosystem diameter; cyclosystems flush and widely spaced versus slightly exsert and denser; dactylotomes open apically versus opening into gastropore tube; diastema absent versus occasionally present; ring palisade consisting of cylindrical elements versus vertical carinae; gastrostyle spines tall and slender (e.g. 41 x 7 µm) versus short and blunt (e.g. 25 x 12 µm).

Coenosteal texture, gastrostyle, and range, mean and mode of dactylopores per cyclosystem are not significantly different in the two species. However, the impression of a similar coenosteal texture is based on only a very small piece of the basal encrustation of *S. rosaceus* used for SEM study.

GREEFF's syntypes of *S. rosaceus* (only one of which is preserved) are the only pink stylasterids from the Gulf of Guinea, thereby strangely contrasting with the many specimens of *S. blatteus* (types included) available for the present study, all of which have the purple colour described by BOSCHMA (1961). If pink *S. rosaceus* and purple *S. blatteus* are just colour variations of one species, they would be expected to occur together, but this apparently is not the case. Some other stylasterid species do show colour variations, generally even among material from one station, e.g. the South African *Errina diffusa* Boschma, 1963b, which may be either white or pink.

The occurrence of *S. rosaceus* at a depth of about 37 m may also point to a specific difference from *S. blatteus*, which is always collected from infralittoral rocks at depths not exceeding 10 m.

REMARKS

Specimens corresponding to the pink *S. rosaceus* as described by GREEFF (1886, under *Allopora*) have never been subsequently collected. BROCH (1914b) reproduced GREEFF's description and added a few details on the surface structure and on the shape of the cyclosystems. In order to preserve the single available syntype undamaged, he forsook any detailed study that required dissection.

According to GREEFF (1886), the main characters distinguishing *S. rosaceus* from *S. blatteus* are the colour (pink in *rosaceus*, deep violet or wine-red in *blatteus*) and the absence of isolated dactylopores between the cyclosystems. GREEFF was wrong on the second point: we found isolated dactylopores on the only preserved syntype. BROCH (1914b) mentioned a difference of the surface structure: in *S. rosaceus* roughly reticulate, the small " fields " being separated by " stripes " of lighter colour; in *S. blatteus* with a fine punctuation (but most specimens of the latter were beach worn). Indications on the cyclosystems by both authors (width, number of dactylopores) are apparently based on a rough comparison and only a few countings. Cyclosystems of *S. rosaceus* are said to be less regularly circular, occasionally also deformed by adjacent ampullae. There are in fact some less regular cyclosystems on the remaining syntype, but this should not be considered significant; irregularities are also observed in *S. blatteus*.

DISTRIBUTION AND ECOLOGY

S. rosaceus is known only from one record at São Tomé (type locality), depth ca. 37 m. No symbionts are known.

Stylaster blatteus (Boschma, 1961)

Fig. 19 A-J, 20 A-F

Synonymy:

Allopora blattea Boschma, 1961: 210-221, pl. 3-6.

Chresonymy:

Allopora subviolacea — GREEFF, 1886: (11-13)16-19. — BROCH, 1914b: 40-41, pl. 1, fig. 6-7. — BOSCHMA, 1957a: 28-89 (part).
Allopora blattea — VERVOORT & ZIBROWIUS, 1981: 27.
Stylaster blatteus — CAIRNS, 1983b: 429.

TYPES

Allopora blattea: The original description by BOSCHMA (1961) was based on many specimens from several localities at Principe and São Tomé, islands in the Gulf of Guinea. One of these colonies (" *Calypso* " 1956, stn 70, São Tomé) was designated by BOSCHMA (pl. 3, fig. 1-2) as holotype, all other colonies from the same and other localities (" *Calypso* " 1956, stn T-25, stn 67, stn 74, stn 111; São Tomé, I. MARCHE-MARCHAD, 1956) as paratypes (pl. 4-6, and other unfigured specimens). Holotype and most paratypes at MNHN. Additional paratypes at RMNH (" *Calypso* " 1956, stn T-25,

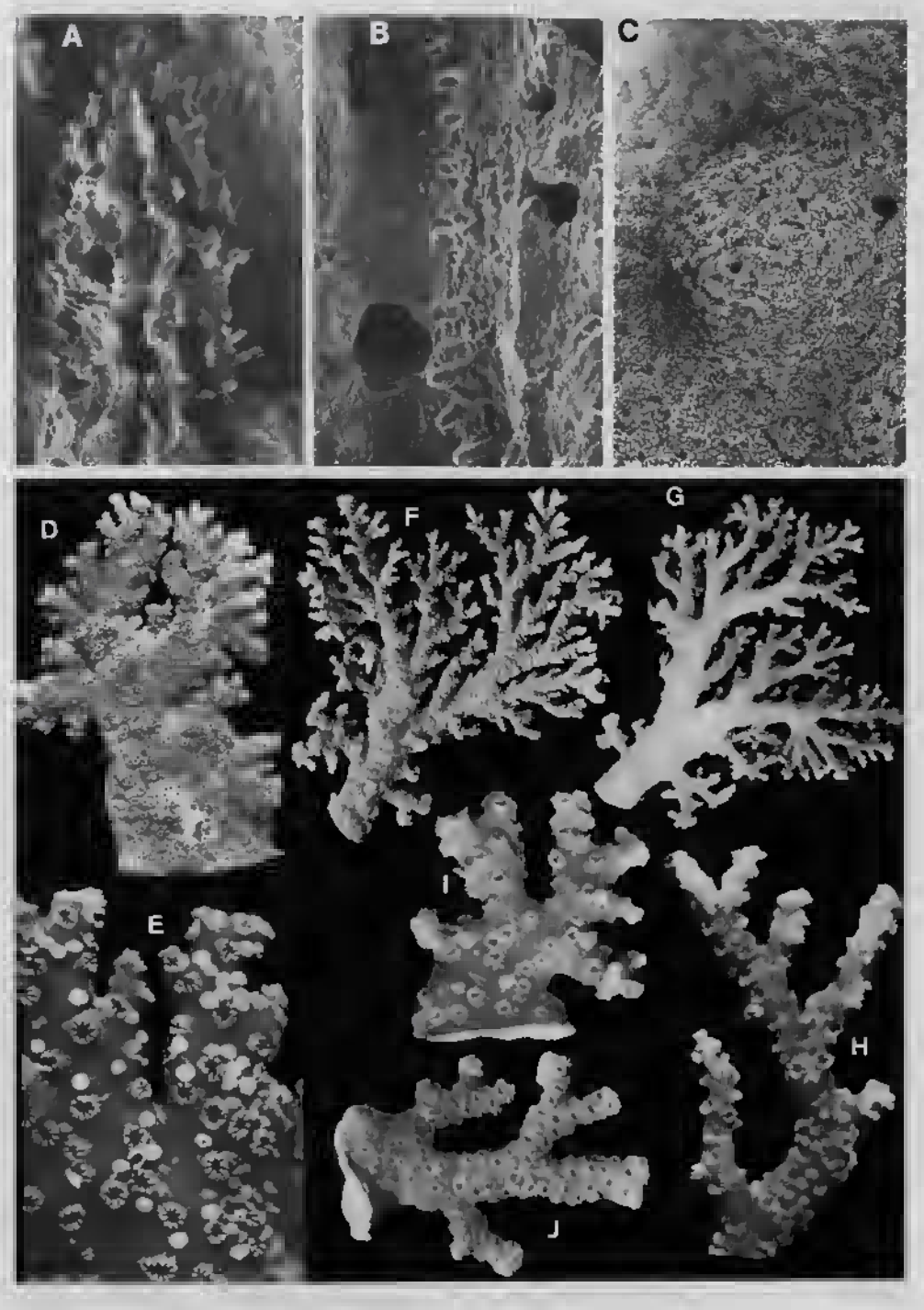

FIG. 19. — *Stylaster blatteus* (A-C, from Praia das Conchas, São Tomé, male, USNM 75614; F-H, same locality, MNHN; D-E, from São Tomé, coll. CPAS, MNHN; I-J, from Principe, Ilheu dos Mosteiros, coll. J. LABOREL, MNHN): A, gastrostyle and ring palisade (× 169); B, dactylostyle (× 253); C, male ampulla with apical efferent pore (× 63); D, robust colony with short stout branches (× 1.2); E, detail of D illustrating cyclosystems and ampullae (× 4.3); F-G, anterior and posterior face of colony witb rather slender branches (both × 0.6); H, slender branch of another colony (× 4.4); I-J, young colonies (× 2.9, × 2.0, respectively).

dry colony Coel 13750A, alcohol preserved material Coel 13750B; São Tomé, I. MARCHE-MARCHAD, 1956, 2 colonies Coel 13902) and USNM (" *Calypso* " 1956, stn T-25, 2 fragments 75613). In addition, the RMNH has fragments from " *Calypso* " 1956, stn T-25 and stn 70 that have been used by BOSCHMA to make preparations, but were not given type status (VERVOORT & ZIBROWIUS, 1981: 27).

Type locality: Holotype (and several, but not all paratypes) from " *Calypso* " 1956, stn 70, 19.6.1956. Praia Santa Catarina on the west coast of São Tomé, 3-10 m.

MATERIAL STUDIED

All specimens listed by BOSCHMA (1961) from the " *Calypso* " cruise in 1956 to the islands in the Gulf of Guinea (see Types), and additional more recently collected specimens.

Principe: " *Calypso* " 1956, stn 111, 7.7.1956, Ilheu dos Mosteiros, 3-10 m, 8 colonies (paratypes). — Ilheu dos Mosteiros, overhang 4-6 m, 18 small colonies, J. LABOREL, Jan. 1971 (most MNHN; USNM 77124).

São Tomé: " *Calypso* " 1956, stn T-25, 15.6.1956, Punta Furada, 3-8 m, 4 colonies + several fragments (paratypes); stn 67, 18.6.1956, Punta Diogo Vaz, 6-10 m, 3 colonies (paratypes); stn 70, 19.6.1956, Praia Santa Catarina, 3-10 m, 8 colonies + several fragments (holotype + paratypes); stn 74, 21.6.1956, São Miguel bay, 6-10 m, 2 colonies (paratypes); same cruise, precise locality not given, I. MARCHE-MARCHAD, several small branches + fragments (paratypes); same cruise, northwestern coast of São Tomé, branch. — São Tomé, without further details, colony collected by divers of Centro Portugues de Actividades Subaquaticas [= CPAS], transmitted by L. SALDANHA. — Praia das Conchas, Guadalupe, 10 m, S. GOFAS, Nov. 1983, 7 colonies (most MNHN; USNM 75614; BMNH).

DESCRIPTION

Colonies robust and primarily uniplanar (Fig. 19 D, F-G): holotype 10.7 cm high and 10.5 cm wide, with a massive basal branch and encrusting base. Branches cylindrical, tbeir distal part following last ramification still rather stout before tapering to tip the diameter of a cyclosystem. Coenosteum purple, reticulate in texture, the strips 35-55 µm wide and separated by deep slits up to 11 µm wide. Strips covered with irregularly shaped pointed granules and short carinae; the granules as small as 10 µm in diameter, the carinae up to 25 µm long and about 7 µm wide (Fig. 20 B).

Cyclosystems occur on all branch surfaces. They are round to slightly elliptical, 0.8-0.9 mm in diameter, rather exsert on their proximal margin and occasionally develop a narrow diastema (Fig. 20 A). Based on 500 cyclosystems, BOSCHMA (1961) found a range of 6-12 dactylopores per cyclosystem, mean 8.88, and mode 9.

Gastropore about 0.3 mm in diameter and 0.65-1.55 mm deep, with a well-defined ring palisade at level of gastrostyle tip. Ring palisade composed of 12-15 vertical carinae (Fig. 20 E-F) up to 80 µm long and 15 µm wide arranged parallel to one another. Gastrostyles 0.30-0.65 mm tall and 0.13-0.24 mm wide (H:W = 2.0-3.9), occupying basal 40-60 % of gastropore. Gastrostyle deeply ridged, bearing short, blunt spines about 25 µm long and 12 µm in diameter. Well developed high dactylotomes about 73 µm wide, opening straight into steep-walled dactylopore tube devoid of shelf; pseudosepta one to four times width of dactylotomes. Narrow distal diastemas occasionally present, especially on large diameter branches. Circular to irregularly shaped isolated dactylopores very common (Fig. 20 C), 60-90 µm in diameter. Dactylostyles rudimentary (Fig. 20 B), composed of a single line of well-spaced cylindrical to clavate elements, each up to 35 µm tall and about 12 µm in diameter. Isolated dactylopores do not have dactylostyles.

Female ampullae (Fig. 20 C-D) smooth, superficial hemispheres 0.50-0.65 mm in diameter, each with an efferent pore about 0.11 mm in diameter. Male ampullae (Fig. 19 C) also superficial, 0.30-0.45 mm in diameter, with 1-3 apical efferent pores, each about 22 µm in diameter. Ampullae of both sexes often clustered (Fig. 19 E, H, 20 D) on both anterior and posterior faces.

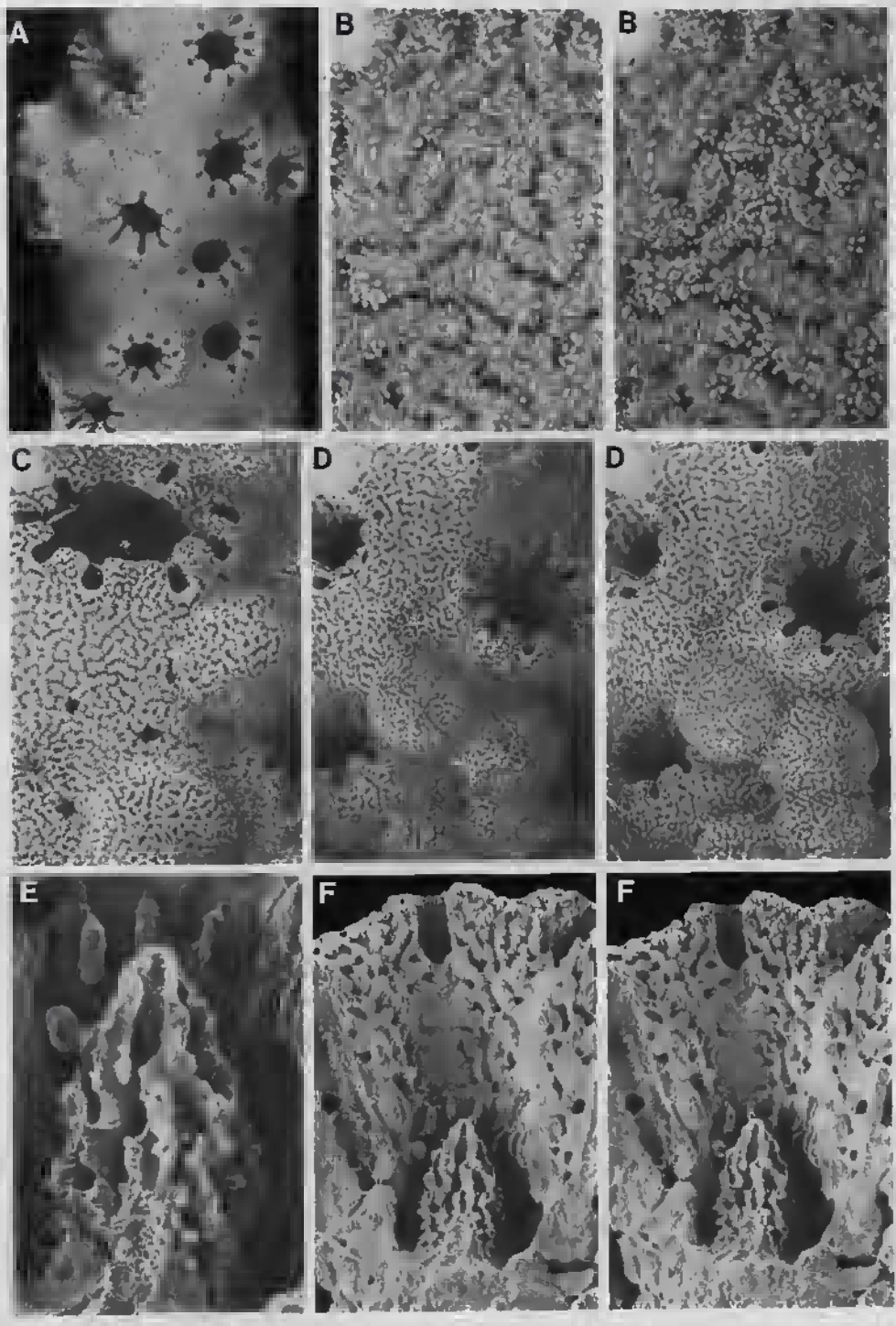

FIG. 20. — *Stylaster blatteus* (A, B-F, from Praia das Conchas, São Tomè, male and female, respectively, USNM 75614): A, branch segment showing cyclosystems and isolated dactylopores (× 14); B, coenosteal texture (× 128, stereo pair); C-D, coenosteum illustrating cyclosystems, female ampullae, and isolated dactylopores (× 32, × 24, respectively; D being a stereo pair); E-F, gastrostyle and ring palisade (× 164, × 64, respectively, F being a stereo pair).

Comparisons

Boschma (1961), who knew *S. rosaceus* only from the literature, questioned whether Greeff's (1886) pink *S. rosaceus* and the sympatric purple *S. blatteus* were distinct species.

We conclude that these forms are different species: *S. blatteus* has purple coenosteum; stouter distal branches; and more densely crowded and exsert larger cyclosystems with higher dactylotomes. Other structures of both species are similar, such as coenosteal texture and gastrostyle, as well as range, mean and mode of dactylopores per cyclosystem.

Young colonies of *S. blatteus* (Fig. 19 I-J) similar in size to the only preserved syntype of *S. rosaceus* are different in aspect, being stouter with more crowded cyclosystems.

Remarks

Greeff (1886), the first collector of the purple stylasterid from the Gulf of Guinea, mistakenly referred it to *Allopora subviolacea* Saville Kent, 1871, at that time known only from the type from unknown origin. Broch (1914b), who reexamined part of Greeff's specimens (beach worn pieces only), had little to add to the previous description.

Boschma (1961) finally had access to abundant new material from the Gulf of Guinea and described it as *Allopora blattea* (the name meaning purple), while his student Goedbloed (1962a, b) studied the dactylozooids and gonophores of this species. Boschma (1966) also examined the type of *A. subviolacea* and redescribed this species from new material from South Africa. Having seen all samples studied by Boschma, as well as additional specimens from the Gulf of Guinea and South Africa, we confirm Boschma's conclusion on the obvious difference of the two species (now absorbed into the genus *Stylaster*).

Distribution and ecology

S. blatteus is known only from the two central islands in the Gulf of Guinea, Principe and São Tomé. The presence of the stylasterid is best documented for São Tomé, which has been more intensively investigated. All records are from shallow water (depth not exceding 10 m), especially from steep cliffs, under overhangs, and in vertical fissures of zones exposed to strong currents (Forest, 1959: 10).

No symbionts are known.

Stylaster maroccanus new species

Fig. 21 A-D, 22 A-G

Types

Type lot comprising 8 specimens collected dead, 3 of them representing lower parts of colonies with the preserved base, the other 5 being colonies without base or detached branches. Holotype largest specimen, colony about 8 mm high, without base, with 8 cyclosystems (Fig. 21 A-B). The other 7 specimens are paratypes. Holotype and most paratypes at MNHN; 1 paratype at USNM (77125).

Type locality: "*Cryos*" cruise BALGIM, stn CP-95, 8.6.1984, 34°24.7'N, 7°39.3'W, 1378 m. Off Atlantic coast of Morocco.

Material studied

Morocco: holotype and paratypes (see above).

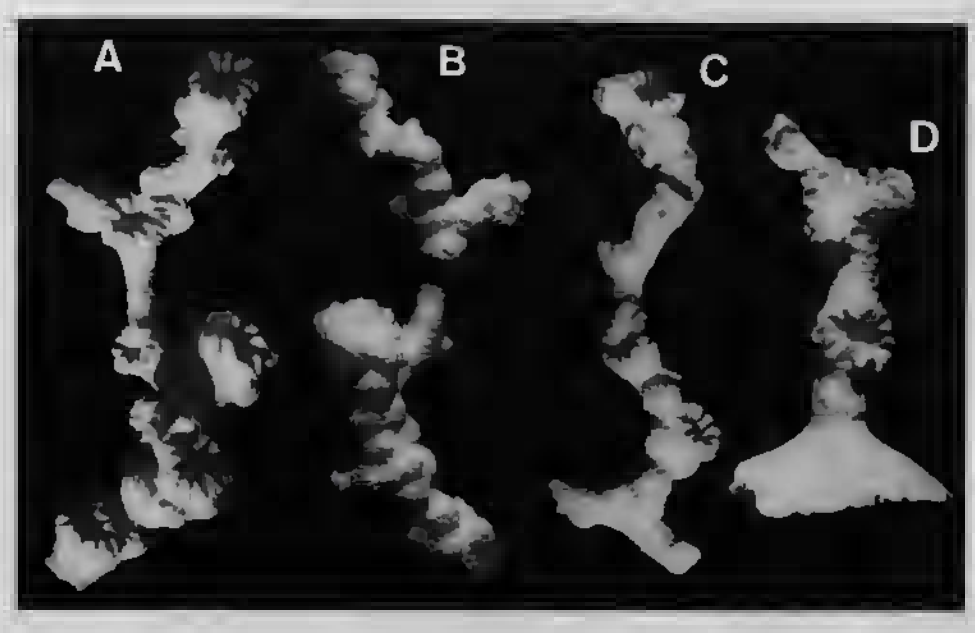

FIG. 21. — *Stylaster maroccanus* (A-D, from " *Cryos* " CP-95, MNHN): A-B, opposite views of female holotype illustrating clustering of ampullae on posterior face (both × 9.0); C-D, paratypes (× 9.0, × 13, respectively).

DESCRIPTION

The few fragmentary specimens available suggest a delicate, bushy corallum. Largest available specimen has only 8 cyclosystems. Branches cylindrical; 0.5-0.7 mm in diameter. All specimens were dead when collected, with poorly preserved coenosteum, some specimens apparently suffering from bioerosion. Coenosteum white and reticulate-granular in texture (Fig. 22 F), the strips about 70 µm wide. No nematopores or isolated dactylopores apparent.

Cyclosystems sympodially arranged on some branches or parts of branches and restricted to anterior face of other branches. Cyclosystems circular to slightly elliptical in shape, 1.0-1.4 mm in diameter. Based on 27 cyclosystems (all available), there is a range of 9-14 dactylopores per cyclosystem, mean 11.77, and mode 11. Some cyclosystems have a narrow diastema.

Only one poorly preserved gastrostyle was examined (Fig. 22 C): it is 0.40 mm high and 0.073 mm wide (H:W = 5.47) and not ridged. Little more detail is known of the gastrostyle; however, the ring palisade is well developed. Elongate elements up to 0.1 mm long, 30 µm wide, and 30 µm high encircle upper third of gastrostyle (Fig. 22 G). Gastrostyle tip extends slightly beyond the ring palisade zone into the slightly expanded upper gastropore chamber. Dactylotomes about 65 µm wide; pseudosepta 1-3 times width of dactylotomes and often slightly concave, especially on their outer edges. Dactylostyle rudimentary, composed of a single line of cylindrical elements.

Female ampullae (Fig. 22 A, D) elliptical in outline, about 0.65 x 0.45 mm, the circular lateral efferent pore at one of the vertices of ellipse. Female efferent pore 0.12 mm in diameter. Male ampullae unknown. Mature female ampullae present on very small branches, indicative of early maturation and/or small colony size.

COMPARISONS

S. maroccanus is a very distinctive species among the eastern Atlantic *Stylaster* (Table 2) based on its cyclosystem orientation, elongate gastrostyles, and very small corallum size. It is perhaps most similar to *S. blatteus*, both having similar dactylostyle and ring palisade morphology; however, it is

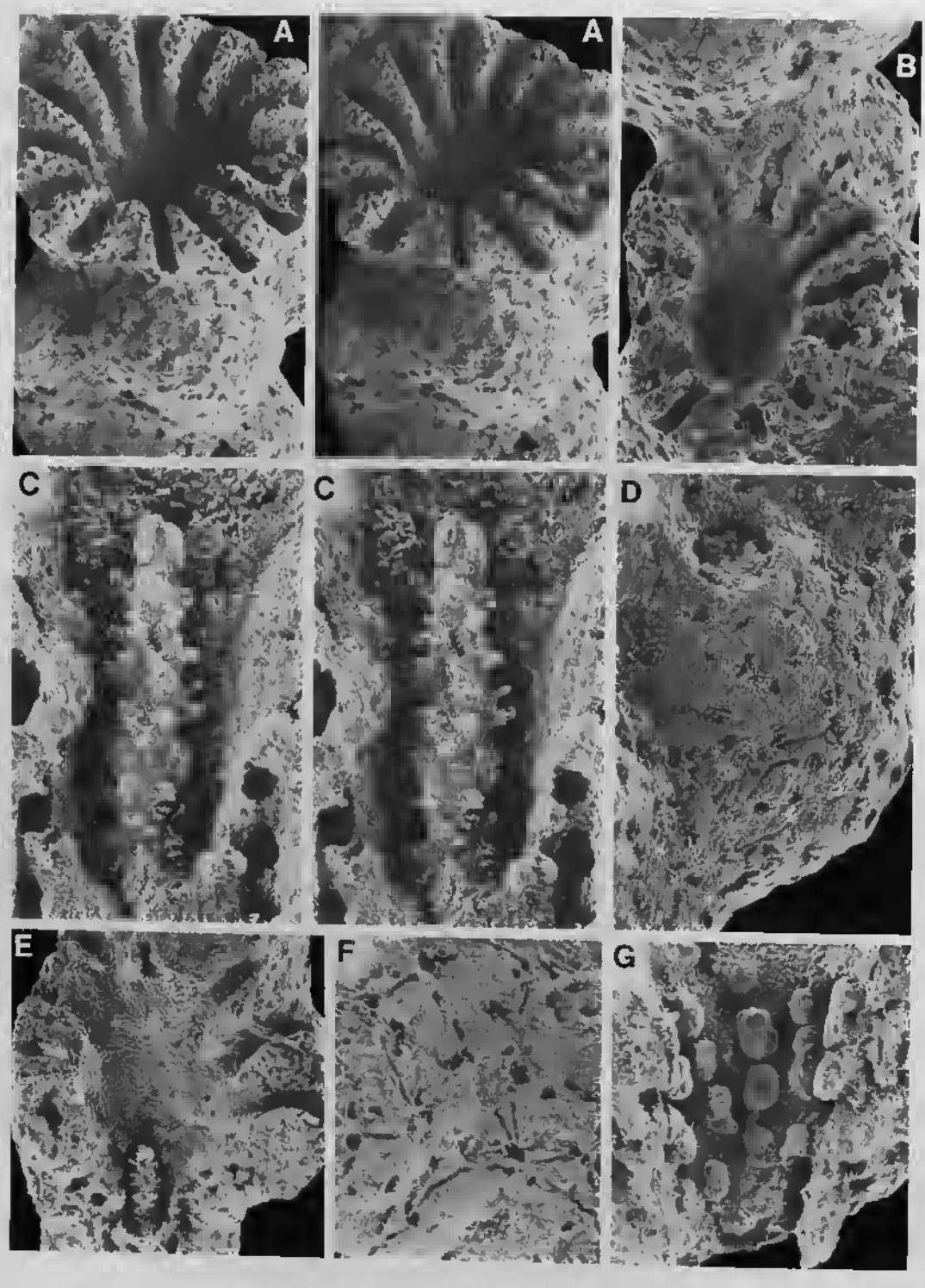

FIG. 22. — *Stylaster maroccanus* (A-G, paratype from "*Cryos*" CP-95, female, USNM 77125): A, cyclosystem surrounded by several ampullae (× 40, stereo pair); B, top view of cyclosystem that has calcified lower gastropore tube, female ampullae and efferent pore above cyclosystem (× 46); C, poorly preserved gastrostyle and ring palisade (× 146, stereo pair); D, female ampulla and efferent pore (× 87); E, longitudinal fracture of cyclosystem revealing gastrostyle of C removed (× 113); F, poorly preserved coenosteum showing bioerosion (?) (× 123); G, well-developed ring palisade, gastrostyle

easily distinguished by its coenosteal color, larger cyclosystems, and greater average number of dactylopores per cyclosystem, as well as by a very different depth and geographic range.

REMARKS

The specific name given to the new species refers to its geographic distribution.

DISTRIBUTION AND ECOLOGY

Species known from one station only (type locality), off the Atlantic coast of Morocco, depth 1378 m.

No symbionts are known.

Stylaster gemmascens (Esper, 1794)

Fig. 23 A-H, 24 A-F

Synonymy:

Madrepora gemmascens Esper, 1790: pl. 55, fig. 1-2; corresponding text 1794: 60.

Chresonymy:

Madrepora virginea — GUNNERUS, 1768: 56, pl. 8, fig. 2-4.
Oculina gemmascens — EHRENBERG, 1834: 303.
Allopora gemmascens — DANA, 1848: 696.
Stylaster gemmascens: MILNE EDWARDS & HAIME, 1850: 98; 1857: 130-131. — SAVILLE KENT, 1871: 281. — SARS, 1873: 115. — DUNCAN, 1873: 332 (part), pl. 49, fig. 4-7. — STORM, 1879: 24; 1882: 25-26. — MOSELEY, 1879: 480; 1881: 86. — NORMAN, 1893: 349. — THOMSON, 1910: 61. — RITCHIE, 1912: 281. — NORDGAARD, 1912: 7. — ARNDT, 1913: 122. — BROCH, 1914a: 8-12, text-fig. C, pl. 1, fig. 4-7, pl. 2, fig. 16, pl. 3, fig. 21, 24-26, 30-31, pl. 4, fig. 32-33, pl. 5, fig. 46, 49-50; 1918: 9, fig. C. — DONS, 1932: 15. — BOSCHMA, 1955a: 22-31, text-fig. 1-3, pl. 1-2; 1956b: F98; 1957a: 10-11; 1958: 71-72. — BOURDON-JONES & TAMBS-LYCHE, 1960: 7.— CAIRNS, 1983b: 430.
Stylaster (*Eustylaster*) *gemmascens* — DONS, 1939: 197.
Allopora oculina — DUNCAN, 1870: 290, 295 (part).
Stylaster sanguineus — THORNELY, 1897: 81.
NOT *Stylaster gemmascens* — HICKSON & ENGLAND, 1905: 12 (Sulu Islands).
NOT *Stylaster* cf. *gemmascens* — EGUCHI, 1941: 1176 (Japan).
NOT *Stylaster gemmascens alaskanus* Fisher, 1938: 500-501, pl. 47, pl. 48, pl. 54, fig. 2 (Aleutian Islands). — BOSCHMA, 1953a: 166; 1957a: 11. — NAUMOV, 1960: 534, fig. 430-431 (Kurile Islands).

TYPES

Madrepora gemmascens: As shown by GRASSHOFF & SCHEER (1991) ESPER's description (1794) was published after the illustration (1790), but opinion No. 574(3b) of the International Commission on Zoological Nomenclature (1959) had already rejected all uses of the binomen *Madrepora gemmascens* prior to ESPER (1794). It was based on presumably only one specimen. BOSCHMA (1955a) described and figured in detail the specimen found in ESPER's collection and regarded it as the " type "; this colony is massive, 10 cm high, 8.5 cm wide, 1.7 cm basal branch diameter (Fig. 23 C-D) and is a male, not a female as suggested by BOSCHMA. In a later publication (BOSCHMA, 1958) it was referred to as the " holotype " and also " selected as the lectotype ". It is now deposited at the SMF, where it had been transferred from Erlangen (VERVOORT & ZIBROWIUS, 1981: 10).

Type locality: According to ESPER (1794), his material came from the East Indian Sea, information which was reiterated by, among others, MILNE EDWARDS & HAIME (1850, 1857). The origin given by ESPER was certainly incorrect: the species is known only from the North Atlantic. Most likely, ESPER's type came from Norway, where the species occurs in relatively shallow water, and where it was already known to GUNNERUS (1768). Accordingly, Norway should be considered as the type locality.

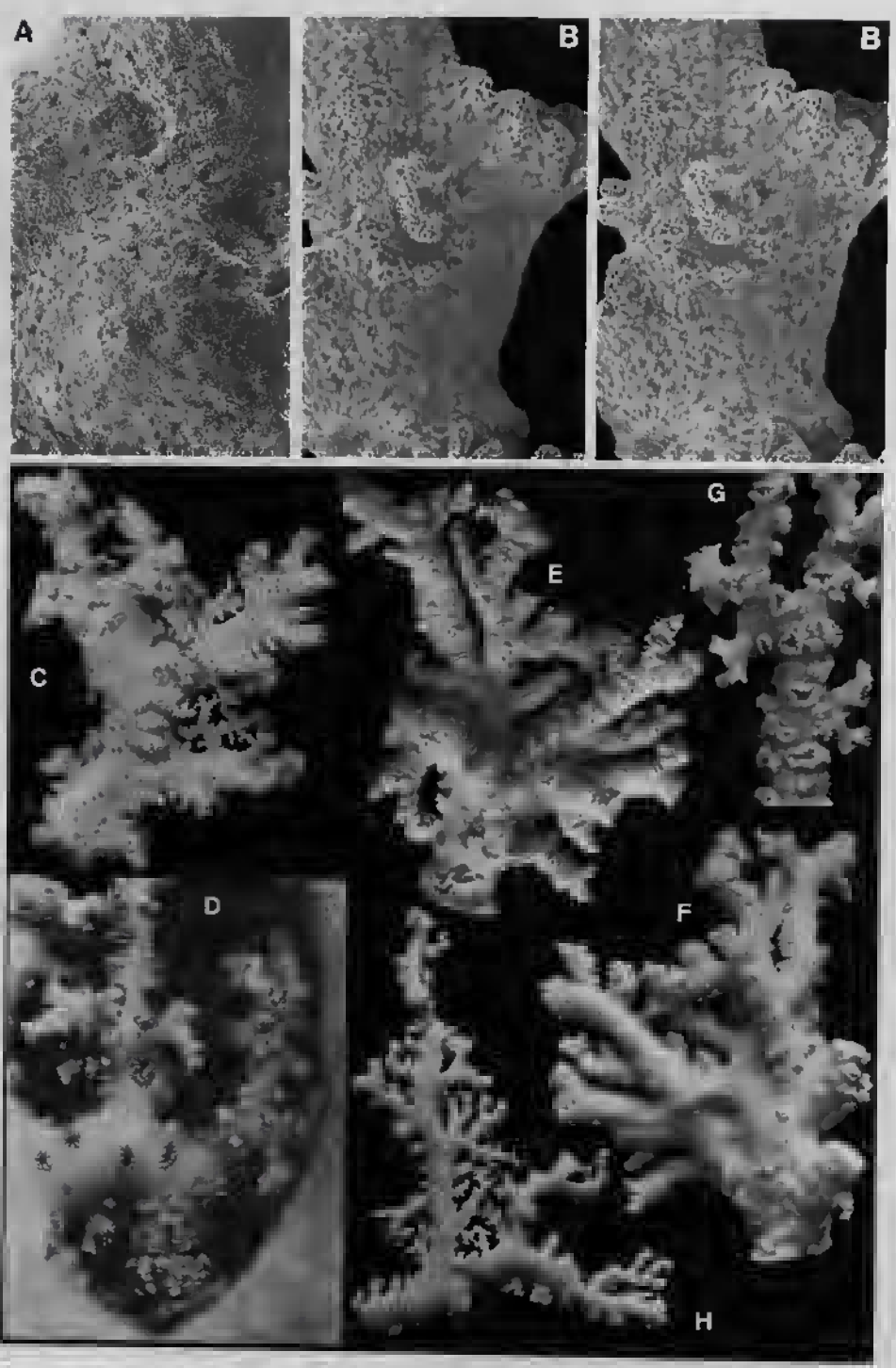

FIG. 23. — *Stylaster gemmascens* (A, from unknown locality, female, USNM 52229; B, from Hardangerfjord, male, USNM 75618; C-D, male holotype, SMF; E-F, from Trondheimsfjord, NHRM 33; G, from Bud, RMNH Coel 15338; H, from Faroes, RSM 1909.191.13): A, female ampulla with efferent pore (× 37); B, male ampulla (× 25, stereo pair); C, massive male colony (× 0.6); D, detail from C illustrating cyclosystem shape and male ampullae covered by papillae (× 3.0); E-F, anterior and posterior faces of colony with crowded stout branches and mostly compressed cyclosystems (both × 1.1); G, branch segment illustrating cyclosystems and male ampullae covered with papillae (× 3.0); H, slender colony (× 1.8).

MATERIAL STUDIED

Denmark Strait: "*Ingolf*" stn 94, many small branches + fragments, dead (ZMUK). — "*Poseidon*" stn 12/1, ca. 430 branches + fragments, dead (SMF 6471; USNM 88825); stn 14/1, ca. 70 branches + fragments, dead (SMF 6474; USNM 88828).

Faroes: off Faroes, taken by fishing boat, colony + fragment (RSM 1909.191.3). — "*Michael Sars*" 1902, stn 43, long line fishing, branch (ZMUK). — "*Dana*" stn 5835, 3 colonies on pebbles (ZMUK); stn 6005, branch (ZMUK). — "*Ingolf*" stn 1, 2 branches (ZMUK); stn 2, 2 branches (ZMUK).

Between Faroes and Hebrides: "*Porcupine*" 1869, stn 54, 4 branches (BMNH 1880.11.13.1-3/7).

Rockall: "*Granuaille*" 1896, branch + fragment (= *Stylaster sanguineus* sensu THORNELY, 1897; BMNH 1898.6.6.1). — J. CORDEAUX, 2 colonies (BMNH 1898.8.25.1). — "*Pisces III*" dive 73-5, fragment of a big photographed colony.

Norway: Various old museum specimens of confused origin are likely to come from Norway. Holotype of *Madrepora gemmascens* (SMF). — Colony labeled "Mer des Indes" (MNHN). — Colony labeled "Océan Indien" (RMNH Coel 15806). — Abundant samples in ZMUO and VSM, from many localities along the Norwegian coast, Hjelmsøystauren, Malangen, Steinavaer, Brettesnes/Lofoten, Sklinna, Rodøy, Trondheimsfjord (including Brettingnes, Hysnes, Røberg, Stornesset, Tömmerdalen), Mefjordsgrunnen/Beian, Sunde/Trondelag, Kristiansund, Skredeness/Sunndalsfjord, Bud, Giske/Sunnmøre, etc. — Trondheimsfjord, KRØYER, colony (NHRM 33). — Rodberg, Trondheimsfjord, ca. 300 m, T. MORTENSEN, 27.7.1911, colonies (ZMUK). — Trondheimsfjord, 40-170 m, 31.8.1961, 10 colonies + branches (RMNH Coel 17414). — Rodberg, Trondheimsfjord, 150-300 m, "*Gunnerus*", 16.3.1926 (RMNH Coel 15335). — Bud, 200 m, "*Gunnerus*" 6.7.1931, 3 branches + fragments (RMNH Coel 15338). — Norway, deep water, colony (BMNH 1896.7.31.1). — Trondheimsfjord, 457 m, C. BOVALLIUS, several colonies + branches (BMNH 1891.5.11.1-3). — Rodberg, Trondheimsfjord, A.M. NORMAN, 1893, several colonies (BMNH 1898.5.7.15). — Rodberg, Trondheimsfjord, A.M. NORMAN, 1893 (BMNH 1922.2.2.6b). — Hardangerfjord, A.M. NORMAN, 1879, ca. 20 colonies on pebbles + branches (most BMNH 1910.10.1.71, 1912.11.30.4-6; USNM 75618). — Norway, colony + 2 branches from Univ. Copenhagen (YPM 1358). — Norway, 2 colonies (USNM 15275). — No locality, female colony (USNM 52229).

DESCRIPTION

Colonies uniplanar to slightly bushy (Fig. 23 C, E-F, H), up to at least 11 cm high and wide. Branches cylindrical; branch tips are diameter of terminal cyclosystems. Coenosteum white to light yellow, reticulate-granular in texture (Fig. 24 C-E). Coenosteal strips uniformly 75-85 µm wide and covered with granules irregular in size and shape, producing a rough texture. Coenosteal papillae (specialized nematocyst structures ?) common on some specimens, particularly around ampullae (Fig. 23 B, G). Papillae cylindrical or carinate: up to 0.8 mm long, 0.2-0.4 mm high, and about 0.10 mm wide.

Cyclosystems occur primarily on lateral edges of distal branches in a sympodial manner, but on larger diameter branches they occur with greater frequency on anterior and posterior branch faces (Fig. 23 C-F). Cyclosystems cirular to irregular in shape, some quite compressed: circular cyclosystems about 1.3 mm in diameter; a compressed cyclosystem might measure 1.6 x 0.7 mm. Proximal dactylopores of cyclosystem project up to 0.8 mm, whereas distal dactylopores usually flush with coenosteum, tending to give the cyclosystem a proximal orientation. Based on 100 cyclosystems examined from the holotype, BOSCHMA (1955) found a range of 6-15 dactylopores per cyclosystem, mean 10.19, and mode 10. Based on 71 cyclosystems examined from five other localities, we found a range of 7-17 dactylopores per cyclosystem, mean 11.76, and mode 12. BOSCHMA's slightly lower average and range may be attributable to his counting cyclosystems in which the distal dactylopores had become obsolete (diastema).

Lower gastropore chamber narrow and cylindrical, about 0.30 mm in diameter, which gives the cyclosystem a flared aspect. Diffuse ring

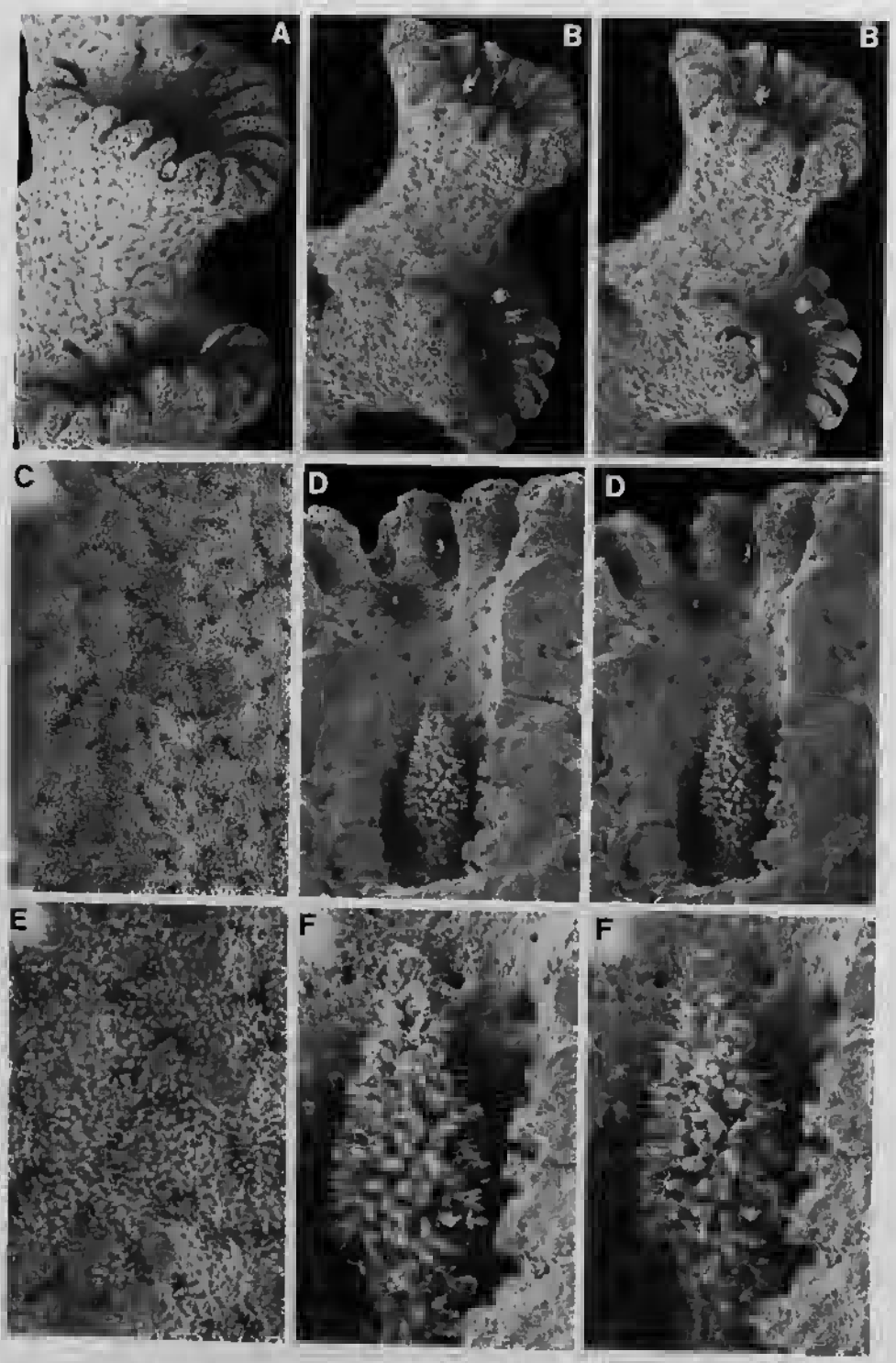

FIG. 24. — *Stylaster gemmascens* (A-C, E, from Hardangerfjord, male, USNM 75618; D, F, from unknown locality, female, USNM 52229): A-B, cyclosystems (× 24, × 21, respectively, B being a stereo pair); C, E, coenosteal texture (× 65, × 128, respectively); D, F, gastropore tube and ring palisade (× 45, × 112, respectively, both being stereo pairs).

palisade present at mid-gastrostyle level, composed of elements about 30 µm in height and diameter. Gastrostyle lanceolate; figured style (Fig. 24 D-E) 0.56 mm high and 0.15 mm in diameter (H:W = 3.7). BOSCHMA (1955) illustrated 15 gastrostyles with H:W ratios ranging from 1.9 to 4.7. Gastrostyles not ridged but bear sharply pointed spines up to 42 µm long. Dactylotomes about 84 µm wide; pseudosepta one to three times width of dactylotome. Dactylostyle rudimentary, composed of a single line of blunt cylindrical elements up to 57 µm high and 11 µm in diameter.

Female ampullae superficial hemispheres (Fig. 24 A) 0.7-0.9 mm in diameter, each with a large efferent pore about 0.24 mm in diameter. Male ampullae also superficial, 0.65-0.75 mm in diameter, often covered by 1-5 papillae or carinae (Fig. 24 B). Male efferent pore not observed.

COMPARISONS

S. gemmascens is one of the most easily distinguished eastern Atlantic *Stylaster*, characterized by a rough coenosteal texture, flared cyclosystems, narrow gastropore tubes, and carinate male ampullae (Table 2).

REMARKS

As pointed out by BROCH (1918), *S. gemmascens* had been well characterized by GUNNERUS (1768) from material from Norway but had been referred to the scleractinian *Madrepora virginea* (Linnaeus, 1758). Figures from GUNNERUS were reproduced by BROCH (1918). The same stylasterid species was again recognizably figured and described by ESPER (1790/1794) as *Madrepora gemmascens* from material said to come from the East Indian Sea (description and figures reproduced by BOSCHMA, 1955a). *S. gemmascens* was then reported from the North Atlantic, starting with SAVILLE KENT (1871), DUNCAN (1873), and SARS (1873). It was often mentioned in papers on the fauna of Norway. Although ESPER's name *gemmascens* was thus in common use for the North Atlantic stylasterid, it became available only by suppression of the senior homonym, *Madrepora gemmascens* Wilkens, 1787, for a scleractinian (BOSCHMA, 1955a, 1958; International commission on zoological nomenclature, 1959: opinion No. 574).

In the northern Atlantic, *S. gemmascens* has occasionally been confused with other species. Material from between the Faroes and the Hebrides reported by DUNCAN, first (1870) as *Allopora oculina*, and later (1873) as *Stylaster gemmascens*, proved to be a mixture of 4 species: *S. gemmascens*, *S. norvegicus*, *S. erubescens britannicus*, and *Stenohelia maderensis*. *Stylaster sanguineus* sensu THORNELY (1897), from Rockall Bank, proved to be *S. gemmascens*; the true *S. sanguineus* Milne Edwards & Haime, 1850, with a pink skeleton, is confined to the southwestern Pacific (ZIBROWIUS, 1981).

S. gemmascens and *S. norvegicus* frequently occur together and have not always been properly distinguished; many lots in museum collections under one or the other name have proved to be a mixture of both species.

The fact that *S. gemmascens* had been reported, first (mistakenly) from the East Indian Sea and then recognized in the northern Atlantic, encouraged other authors to accept its wide geographic range, and to uncritically refer somewhat similar forms from other areas to the same species.

The North Pacific *S. gemmascens alaskanus* Fisher, 1938, first reported from the Aleutian and subsequently from the Kurile Islands (NAUMOV, 1960), should not be considered as *S. gemmascens*. CAIRNS (1983b: 430) listed it as a distinct species, *S. alaskanus*, in Group C (and not Group B) within the genus *Stylaster*.

S. gemmascens sensu HICKSON & ENGLAND (1905), from the Sulu Islands (southern Philippines), is also different (ZMA Coel 7386). The insufficiently known S. cf. *gemmascens* sensu EGUCHI (1941) from Japan is also undoubtedly misidentified.

Distribution and ecology

S. gemmascens is known from a wide area in the North Atlantic, from Denmark Strait east of Greenland (off Angmagssalik) and northwest of Iceland through the Faroes – Hebrides area to Norway and Rockall. The occurrence in Icelandic waters is here reported based on Broch (1914a); from all other areas material was available for the present study. The species is new for eastern Greenland. The northernmost records are 66°18′N in Denmark Strait, and 71°07′N in Finmark, Norway.

Along the Norwegian coast the species is common in depths of about 40 m to 400 m, frequently found together with the bankforming scleractinian *Lophelia pertusa*. Elsewhere, the species has been collected down to 621 m northwest of Iceland, and at 665 m between the Faroes and Hebrides. On Rockall Bank large colonies have been photographed and collected by the submersible "*Pisces III*" in depths of 160-190 m.

No symbionts are known.

Stylaster ibericus new species

Fig. 25 A-O, 26 A-G

Types

All available specimens from seven closely adjacent stations of northwestern Spain are given type status: "*Thalassa*" stn U-807, 2 colonies fused at the base; stn Y-428, 4 encrusting bases of colonies; stn Y-430, 21 colonies + 10 branches + fragments; stn Y-431, branch; stn Y-432, colony + 3 branches; stn Y-438, dead branch; stn Y-440, 28 colonies, branches, fragments, mostly dead. A rather complete fan-shaped colony 30 mm high and 42 mm wide from stn Y-430 is designated holotype (Fig. 25 H), all other specimens from stn Y-430 and the other stations paratypes. Holotype and most paratypes at MNHN, 4 paratypes from stn Y-430 at USNM (75619).

Type locality: "*Thalassa*" stn Y-430, 4.9.1972, 44°1.6′N, 8°40.6′W, 500 m. Off northwestern Spain.

Material studied

NW Spain: Holotype and paratypes (see above).

Description

Colonies uniplanar, up to 40 mm high and wide (Fig. 25 F-H, L-O). Branches cylindrical, about 1.5 mm in distal branch diameter. Coenosteum glistening white. Coenosteal texture smooth, resulting from a reticulate-granular coenosteum with very few low granules, each about 11 µm in diameter. As in *S. norvegicus*, some colonies show a transition of coenosteal textures from coarse, disjointed granules (Fig. 26 D) to a smooth, almost porcelaneous coenosteum (Fig. 26 C). Coenosteal strips 45-95 µm wide.

Cyclosystems circular to slightly elliptical, 0.8-1.1 mm in diameter, occurring primarily on lateral to anterolateral branch edges. Occasionally some cyclosystems occur on anterior face and, more rarely, posterior face. Cyclosystems all slightly exsert, extending about 0.4 mm above coenosteum. Based on 685 cyclosystems, there is a range of 4-11 dactylopores per cyclosystem, mean 7.71, and mode 8. These data include the single branch from stn Y-438 which has many cyclosystems with a low number of dactylopores: based on 70 cyclosystems, its range is 4-8, mean 6.00, and mode 6. There are no diastemas.

Gastrostyle occupies lower half of gastropore chamber, which is constricted at level of gastrostyle tip (Fig. 26 E). Gastrostyle ovate and sharply pointed, its widest section being at mid-height, caused by the perpendicular projection of very long spines. Illustrated style (Fig. 26

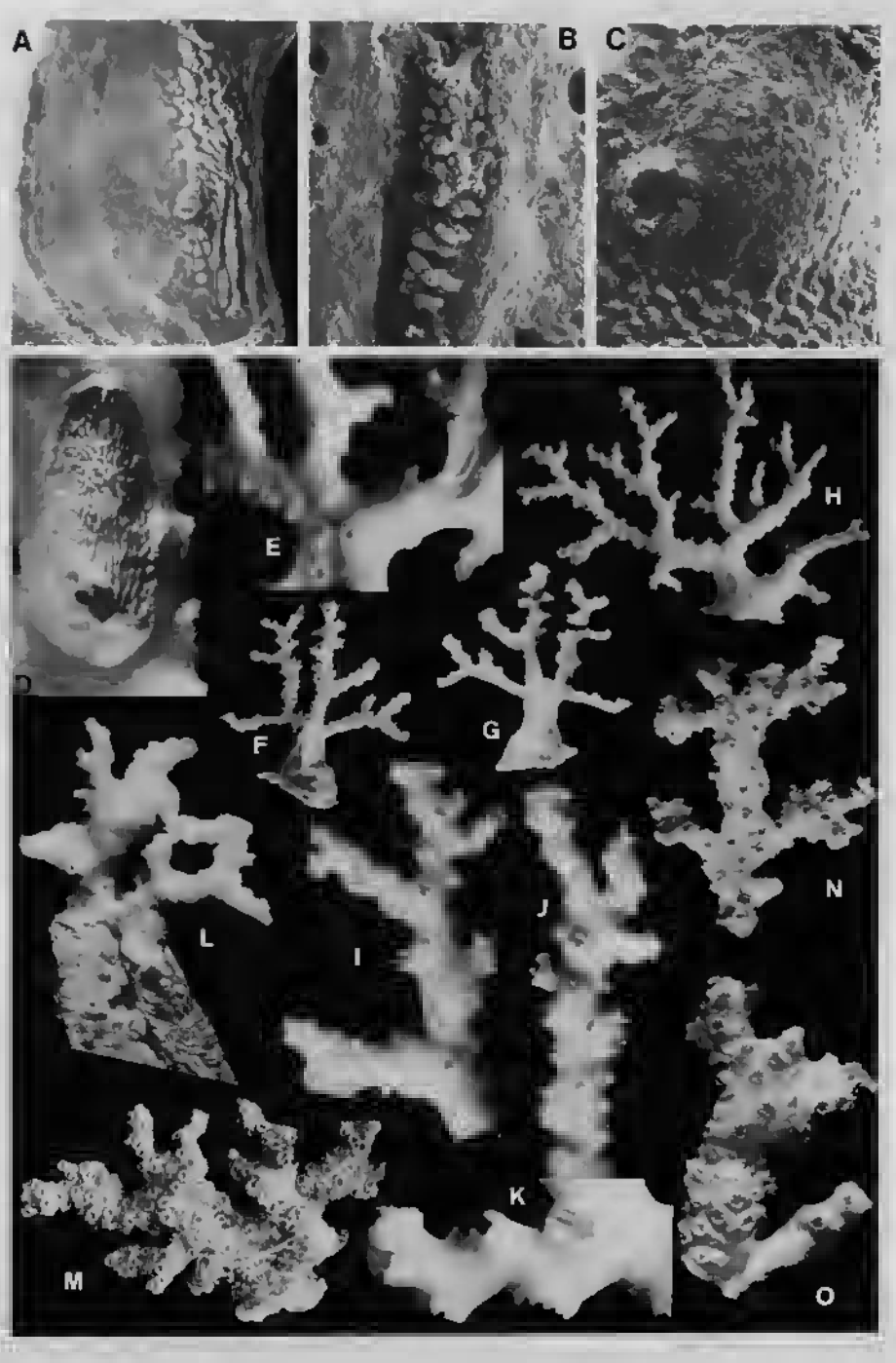

FIG. 25. — *Stylaster ibericus* (A-B, paratype from " *Thalassa* " Y-430, male, USNM 75619; C, paratype from " *Thalassa* " Y-440, female, MNHN; D-K, from " *Thalassa* " Y-430, MNHN; L, from " *Thalassa* " U-807, MNHN; M-N, from " *Thalassa* " Y-440, MNHN; O, from " *Thalassa* " Y-438, MNHN): A, *Pedicularia* trace (× 13); B, dactylostyle (× 125); C, female ampulla and efferent pore (× 39); D, *Pedicularia* trace (× 6.8); E, detail of paratype with two *Pedicularia* traces (× 2.5); F-G, opposite views of paratype, *Pedicularia* trace near the base (both × 1.1); H, holotype (× 1.1); I-K, branches of holotype showing sympodial arrangement of cyclosystems (× 3.0, × 3.1, × 4.9 respectively); L, two paratypes on cirriped shell, next to base of right colony some very young stages consisting of a single cyclosystem (× 1.9); M-N, stouter dead paratype (× 1.3, × 1.5, respectively); O, stouter dead paratype characterized by cyclosystems with low dactylopore number (× 2.1).

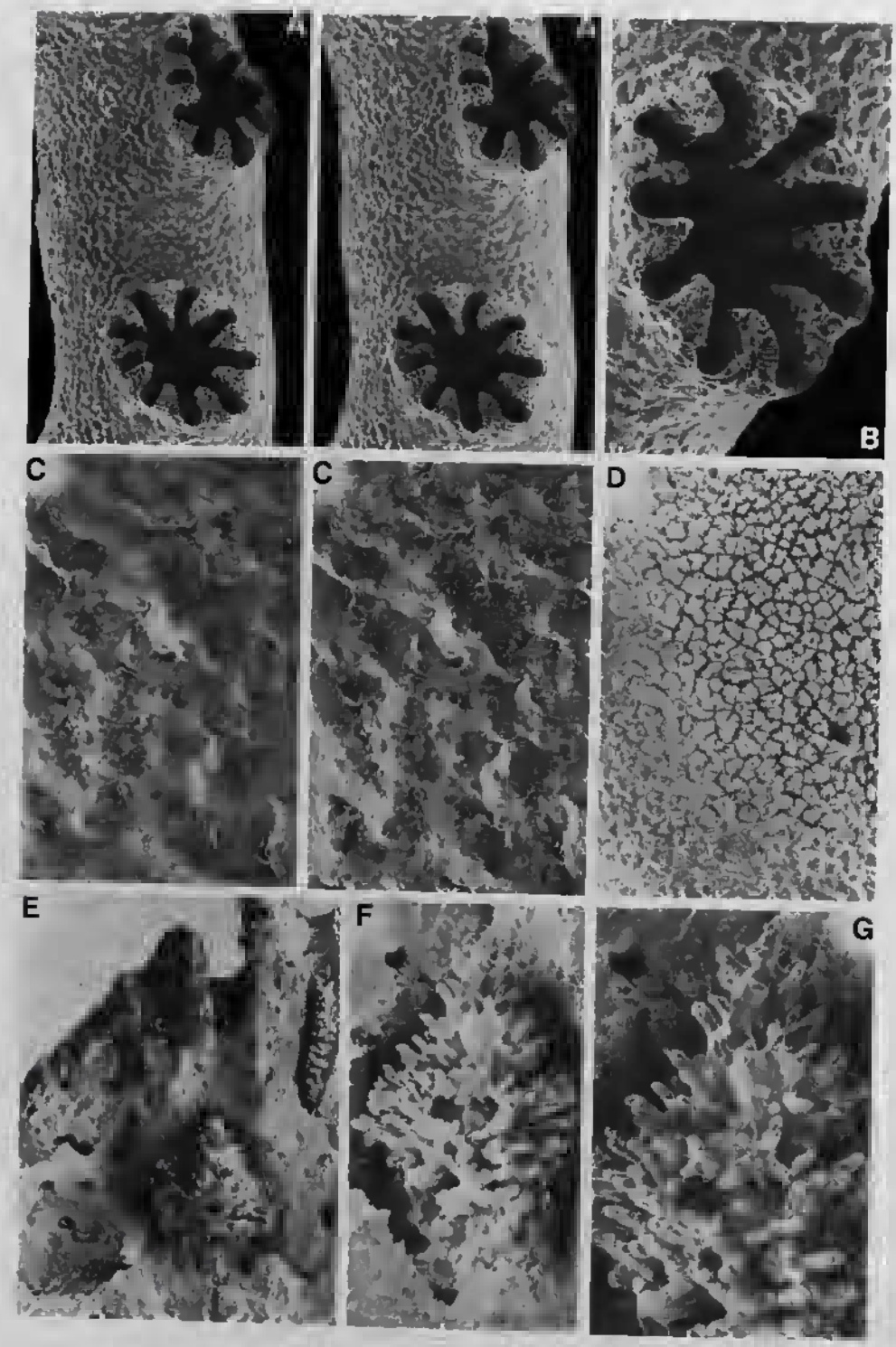

FIG. 26. — *Stylaster ibericus* (A-G, paratype from " *Thalassa* " Y-430, male, USNM 75619): A, branch segment with two cyclosystems (× 21); B, cyclosystem (× 43); C, coenosteal texture (× 141, stereo pair); D, transitional coenosteal texture (× 30); E, fractured cyclosystem revealing gastrostyle, dactylostyle, and internal male ampulla (× 54); F-G, gastrostyle (× 106, × 165, respectively).

F-G) 0.46 mm high and 0.24 mm in diameter (H:W = 1.9); another style with H:W = 1.3. Gastrostyle spines cylindrical and blunt, up to 60 µm long and 11 µm in diameter. Spines often laterally fused into transverse or oblique tiers. Gastrostyle not ridged. Dactylotomes about 0.12 mm wide. Dactylostyles robust, composed of blunt, cylindrical elements up to 50 µm tall and 15 µm in diameter. Dactylostyle elements basally fused and occur 3 or 4 across the width of dactylostyle (Fig. 26 B).

Male ampullae internal, about 0.5 mm in internal diameter. Male efferent pores small concavities about 0.15 mm in diameter. Female ampullae elongate and very low in relief (0.75-1.0 mm in diameter and about 0.25 mm tall); efferent pore about 0.18 mm in diameter, lateral in position but inclined upward (Fig. 25 B).

Comparisons

S. ibericus is similar to *S. erubescens britannicus*, particularly regarding cyclosystem diameter, gastro- and dactylostyle morphology, and internal male ampullae. These are the only two eastern Atlantic taxa of *Stylaster* known to have internal male ampullae. *S. ibericus* is distinguished by its smooth, porcellaneous coenosteum; higher average number of dactylopores per cyclosystem (9.34 versus 7.71), and normally shaped pseudosepta (Table 2).

Remarks

The specific name given to the new species refers to its geographic distribution.

Distribution and ecology

S. ibericus is known from 7 closely adjacent dredging stations in the La Coruña area, northwestern Spain. The species lives solidly attached to big boulders apparently exposed to bottom currents (no sediment in dredge).

Symbionts

Specimens of *Pedicularia* have been found on live colonies of *S. ibericus* from 2 stations ("*Thalassa*" stn Y-430, Y-432). Dead branches from a third station (Y-440) also show typical *Pedicularia* traces (Fig. 25 D, 26 D).

Stylaster erubescens Pourtalès, 1868

Material from the study area identified as *S. erubescens* differs in several aspects from specimens of the nominotypical western Atlantic form (north to North Carolina) previously described by Cairns (1986a). Largely a matter of degree, these differences appear insufficient to justify the description of distinct species; accordingly, these geographically nonoverlapping forms are presented here as subspecies of *S. erubescens*: *groenlandicus* n. ssp., *britannicus* n. ssp., and *meteorensis* n. ssp., the western Atlantic nominotypical subspecies being *S. erubescens erubescens*.

Stylaster erubescens erubescens Pourtalès, 1868

Synonymy:

Stylaster erubescens Pourtalès, 1868: 135-136.

Chresonymy:

Stylaster erubescens: Pourtalès, 1871: 34, pl. 4, fig. 10-11; 1878: 210. — Broch, 1914a: 12 (only in synonymy of *Stylaster roseus*). — Boschma, 1955b: 135-138 (part: not North Atlantic); 1957a: 8 (part: not

North Atlantic); 1965c: 235-236, 245-247, pl. 4, fig. 1-4 (part: NOT North Atlantic). — ZIBROWIUS & CAIRNS, 1982: 210, 212 (part: NOT East and North Atlantic). — CAIRNS, 1983b: 430; 1986a: 58-61, fig. 26A-H (part: NOT Northeast Atlantic).

TYPES

Stylaster erubescens: In the original description (POURTALÈS, 1868) the species is qualified as " rather common between 120 and 324 fathoms [220-592 m] off the Florida reef " (area known as Pourtalès Terrace); this information was reiterated in a later publication (POURTALÈS, 1871). Types were not specially designated. According to CAIRNS (1986a), there is only one larger syntype (fan-shaped colony about 80 mm high, 117 mm wide) at the MCZ, with data corresponding to the 1868 description (Florida, 120-324 fathoms). He also recognized additional syntype branches at USNM (71822), YPM, and RMNH. Five branches at BMNH (1869.10.25.11, 1891.2.4.15, 1894.12.22.6) also deserve syntype status.

Type locality: Pourtalès Terrace (Florida), 220-592 m.

MATERIAL STUDIED

For western Atlantic material north to North Carolina see CAIRNS (1986a).

DESCRIPTION

See CAIRNS (1986a), description based on the western Atlantic nominotypical subspecies.

COMPARISONS

See Table 2 and Comparisons of the 3 new subspecies.

REMARKS

BROCH (1914a) incorrectly included *S. erubescens* as a synonym of *S. roseus* (Pallas, 1766). As already demonstrated by BOSCHMA (1955b, 1957a, 1965c), *S. erubescens* and *S. roseus* are distinct species. The latter (redescribed by CAIRNS, 1986a), is primarily a shallow-water species widespread throughout the Caribbean and ranging south to Brazil.

S. erubescens has been mistakenly reported by early authors from beyond the confirmed range of its four subspecies presently known in the northwestern and northeastern Atlantic: by MOSELEY (1876b: 94) from " *Challenger* " stn 320 in the southwestern Atlantic (subsequently described as a distinct species, *S. densicaulis* Moseley, 1879; redescribed by CAIRNS, 1983a; types BMNH 1880.11.25.175/199); by THOMSON (1877: vol. 2, 267) from " *Challenger* " stn 344 off Ascension Island (mentioned by MOSELEY, 1879: 450; 1881: 58) as *S. granulata* (*nomen nudum*; material not at BMNH); and by MOSELEY (1881: 81) from " *Challenger* " stn 170 off the Kermadec Islands (in reality *Conopora verrucosa* (Studer, 1878), BMNH 1880.11.25.178).

DISTRIBUTION AND ECOLOGY

S. erubescens (nominotypical subspecies *erubescens*) was known to POURTALÈS (1868, 1871, 1878) exclusively from off southeastern Florida. CAIRNS (1986a) provided a station list for this form that he qualified as the most commonly collected stylasterid of the western Atlantic. The distribution was given as comprising the continental shelf and slope of the southeastern United States, from the Blake Plateau off South Carolina to off southwestern Florida, and extending to Little Bahama Bank, Cay Sal Bank, and Arrowsmith Bank off Yucatan Peninsula, depth 146-965 m, but most common at 650-850 m.

Symbionts

In the western Atlantic *S. erubescens erubescens* is one of the rare stylasterids known as the host of *Pedicularia*; traces have been found on material from one of the northern localities ("*Albatross*" stn 2416, off Georgia, 505 m; USNM 10542).

In the western Atlantic, Cairns (1986a) found about half of the colonies with gall-tubes induced by a polynoid polychaete, an association first noticed by Pourtalès (1869).

Stylaster erubescens groenlandicus new subspecies

Fig. 27 A-H, 28 A-H

Chresonymy:

Stylaster roseus — Broch, 1914a: 12-15, pl. 1, fig. 8-9, pl. 2, fig. 10, 11, 17, pl. 3, fig. 22, pl. 4, fig. 36, 39, pl. 5, fig. 43, 47-48 (part); 1936: 15.

Stylaster erubescens — Boschma, 1955b: 135-138 (part: North Atlantic); 1957a: 8 (part: North Atlantic); 1965c: 236, 246 (part: North Atlantic). — Zibrowius & Cairns, 1982: 212 (part: East and North Atlantic). — Cairns, 1986a: 61 (part: Northeast Atlantic).

Types

Most available material from Greenland through Denmark Strait ("*Poseidon*" excepted) to southeast of Iceland is given type status: a male colony 61 mm high and 40 mm wide from "*Ingolf*" stn 15 is designated holotype (Fig. 27 C), all other specimens from "*Ingolf*" stn 15 and various other stations paratypes (see Material studied). Holotype deposited at ZMUK, together with most paratypes from type locality.

Type locality: "*Ingolf*" stn 15, 4.6.1895, 66°18'N, 25°59'W, 621m. Denmark Strait, northwest of Iceland.

Material studied

Denmark Strait and Greenland: "*Ingolf*" stn 15, 18 colonies + 26 branches + numerous fragments (holotype + paratypes, ZMUK, USNM 77123); stn 16, 2 branches (paratypes ZMUK). — East Greenland Expedition 1900, off Angmagssalik, 263 m, 5 colonies + 2 branches (paratypes, ZMUK, USNM 77122). — "*Walther Herwig*" stn 538-24, 2 male branches (paratypes, IMFB). "*Vema*" stn v17/RD-29, 7 colonies + 5 branches + fragments, male + female (paratypes, USNM 60004). — "*Poseidon*" stn 12/1, ca. 260 branches + fragments, most dead, only one alive (SMF 6472; USNM 88826); stn 14/1, ca. 50 branches + fragments, dead (SMF 6475; USNM 88829).

Iceland: "*Ingolf*" stn 7, 2 colonies + 7 branches (paratypes, ZMUK); stn 52, 16 branches (paratypes, ZMUK). — "*Bartlett*" 1975, stn 52c-5, male branch (paratype, USNM 60005).

Description

Colonies uniplanar (Fig. 27 A, C), up to 80 mm high with a basal diameter of 7 mm (East Greenland exped. specimens); branches sometimes thickened (Fig. 27 C) as in nominotypical subspecies but evidence of polynoid symbiont not observed. Coenosteum white and reticulate-granular in texture (Fig. 28 D). Strips 70-90 µm wide and fairly continuous, covered with small rounded granules 8-10 µm in diameter.

Cyclosystems primarily on lateral and antero-lateral branch edges but some occasionally on anterior and posterior branch faces. Cyclosystems circular to slightly elliptical in shape, 1.2-1.4 mm in diameter (Fig. 28 A-B). Based on 175 cyclosystems, there is a range of 5-15 dactylopores per cyclosystem, mean 10.15, and mode 10.

Gastrostyle conical (Fig. 28 E-F), about 0.50 mm tall and 0.25 mm wide in greatest width, with H:W ratios around 2. Style covered with blunt, cylindrical spines about 40 µm long and 15

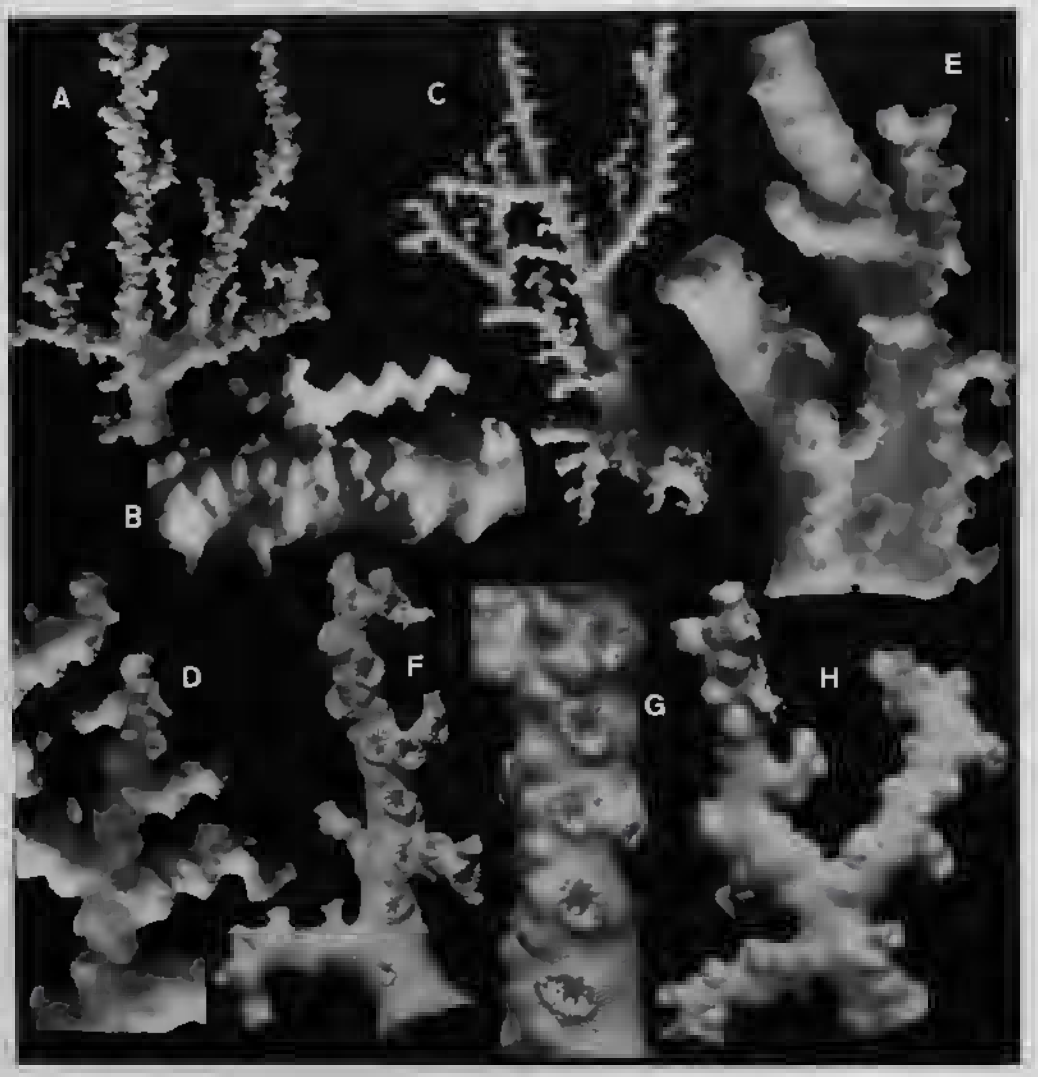

FIG. 27. — *Stylaster erubescens groenlandicus* (A-D, from "*Ingolf*" stn 15, ZMUK; E, from "*Bartlett*" 1975, 52C-5, USNM 60005; F-H, from "*Vema*" V17/RD-29, USNM 60004): A, female paratype with abundant clustered ampullae (× 1.0); B, detail of A illustrating large female ampullae (× 3.2); C, male holotype (× 1.0); D, detail of holotype illustrating small male ampullae (× 3.2); E, male paratype with particularly thickened branches (× 2.1); F, male paratype (× 2.9); G, detail of female paratype illustrating large ampullae and gastrostyles in depth of cyclosystems (× 4.3); H, female paratype with large ampullae (× 3.0).

μm in diameter, the bases of which are fused into transverse or oblique tiers as in *S. norvegicus* and *S. ibericus*. Dactylotomes about 0.12 mm wide; dactylostyles robust. Pseudosepta usually equal to dactylotomes width (Fig. 28 G). Diastemas present on cyclosystems positioned at branch axils (Fig. 28 C) and on larger diameter branches.

Female ampullae large superficial hemispheres (Fig. 27 B, 28 C) 1.0-1.3 mm in diameter, sometimes with a short lateral efferent tube. Female efferent pore about 0.20-0.25 mm in diameter; binary ampullae sometimes present. Male ampullae (Fig. 27 D, 28 H) superficial mounds 0.7-0.8 mm in diameter, becoming internal on large diameter branches. Male efferent pore circular, 80-90 μm in diameter, and located laterally (Fig. 27 D, 28 H), not apically. Both genders of ampullae often densely clustered, especially the males, on anterior and posterior branch faces (Fig. 27 A-H).

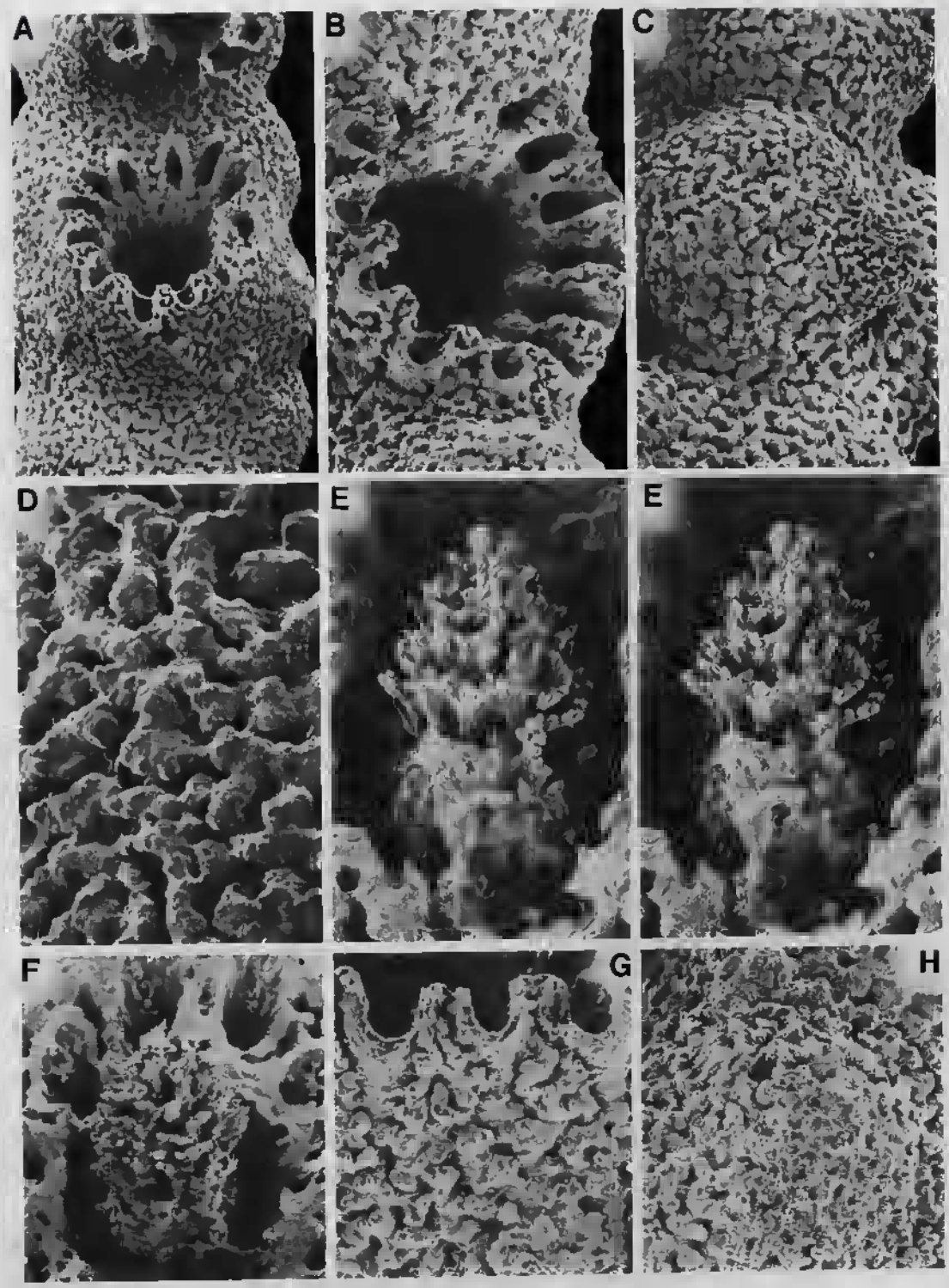

FIG. 28. — *Stylaster erubescens groenlandicus* (A-B, E-H, male paratype from "*Ingolf*" stn 15, ZMUK; C-D, female paratype from "*Ingolf*" stn 15, ZMUK): A-B, cyclosystem (× 24, × 41, respectively); C, female ampulla and efferent tube (× 33); D, coenosteal texture (× 92); E, gastrostyle (× 116, stereo pair); F, gastrostyle surrounded by damaged dactylostyles (× 69); G, outer edges of pseudosepta, coenosteal texture (× 56); H, male ampulla with efferent pore (× 56).

COMPARISONS

S. erubescens groenlandicus is clearly most similar to the nominotypical subspecies, both having the same coenosteal texture, thickened branches, and relatively large cyclosystems (Table 2). Their differences are largely a matter of degree: *S. erubescens groenlandicus* has a slightly lower average number of dactylopores per cyclosystem, a higher gastrostyle H:W ratio, and larger ampullae of both sexes. One qualitative difference concerns the male efferent pores, which are lateral in *S. erubescens groenlandicus* and apical in *S. erubescens erubescens*.

S. erubescens groenlandicus can be distinguished from the other two subspecies on the basis of coenosteal texture, cyclosystem diameter, gastrostyle shape, and ampullar position and size (Table 2).

REMARKS

The name given to the new subspecies refers to its geographic distribution.

BROCH (1914a) was the first to report corals referable to *S. erubescens groenlandicus* from the northern Atlantic (specimens from 3 stations figured), but he incorrectly included *S. erubescens* as a synonym of *S. roseus* (Pallas, 1766). BOSCHMA (1955b, 1957a, 1965c) corrected this identification to *S. erubescens*, but did not examine BROCH's material.

Material mentioned by BROCH (1914a) from 3 stations between Greenland and Iceland (" *Ingolf* " stn 17, 94; " *Thor* " 1904) was not available for the present study; most likely this was ssp. *groenlandicus*, also obtained from other stations in the same area.

DISTRIBUTION AND ECOLOGY

S. erubescens groenlandicus is separated from the nominotypical subspecies by a broad geographic hiatus extending from South Carolina (32°24'N) to Greenland (60°27'N). It is geographically nearest to *S. erubescens britannicus* which extends north to southeast of Iceland.

BROCH (1914a) reported *S. erubescens groenlandicus* (misidentified as *S. roseus*) from 7 stations (mainly " *Ingolf* ") in the North Atlantic, from east of Greenland to northwest and southeast of Iceland, all north of 60°N. We have seen additional material of the same form from 6 stations. BROCH's data combined with ours cover a depth range from 263 m to 1440 m. The northernmost record is 66°18'N in Denmark Strait, northwest of Iceland.

No symbionts are known.

Stylaster erubescens britannicus new subspecies

Fig. 29 A-G, 30 A-G

Chresonymy:

Allopora oculina — DUNCAN, 1870: 90, 95 (part).
Stylaster gemmascens — DUNCAN, 1873: 322 (part), pl. 49, fig. 8-10.
Stylaster erubescens — WILSON, 1979: 157. — ZIBROWIUS & CAIRNS, 1982: 212 (part: East and North Atlantic). — CAIRNS, 1986a: 61 (part: Northeast Atlantic).

TYPES

All available material (except " *Dana* " stn 6001) from southeast of Iceland through Rockall Trough to the Celtic Sea is given type status: a female specimen (17 mm high, 24 mm wide) collected by C. WANDEL, SE Iceland, is designated holotype (Fig. 29 A), all other specimens from the same and various other stations paratypes (see material studied). Holotype deposited at ZMUK, together with most paratypes from type locality.

Type locality: 64°16'N, 11°15'W, 350 m, C. WANDEL, 19.9.1891. Southeast of Iceland.

FIG. 29. — *Stylaster erubescens britannicus* (A-C, from southeast of Iceland, coll. C. WANDEL, ZMUK; D-E, from "*Porcupine*" stn 54, BMNH 1883.12.10.92, 1880.11.13.6; F, from "*John Murray*" site 4/dredge, BMNH 1986.11.5.1; G, from "*Thalassa*" Z-435, USNM 75614): A, female holotype (× 2.1); B, detail of A (× 3.2); C, male paratype (× 2.3); D-E, male paratypes (× 1.6, × 2.0, respectively); F, male paratype (× 1.8); G, paratype (× 3.6).

MATERIAL STUDIED

SE Iceland: 6 branches from Type locality (holotype + paratypes, ZMUK, USNM 75617). — "*Dana*" stn 6001, tiny poorly preserved colony, tentatively assigned to this subspecies (ZMUK).

N Faroes: "*Ingolf*" stn 144, fragment (paratype, ZMUK).

Between Faroes and Hebrides: "Porcupine" stn 54, 3 branches (paratypes, BMNH 1880.11.13.6/6a, 1883.12.10.92).

Rockall Trough: "*John Murray*", site 4/dredge, male branch (paratype, BMNH 1986.11.5.1).

Celtic Sea: "*Thalassa*" stn z-430, dead male branch (paratype, MNHN); stn z-435, 2 branches (paratypes, MNHN, USNM 75614).

Description

Colonies uniplanar (Fig. 29 A-F), up to 43 mm high and 28 mm wide. Branches delicate, not thickened. Coenosteum white, composed of coarse granules (Fig. 30 B) 40-60 µm in diameter, some of which are fused into short strips up to 0.25 mm long. Smaller granules about 8 µm in diameter occur on lower edges of coarse granules.

Cyclosystems primarily on lateral and anterolateral branch edges (Fig. 29 A, C), although some occasionally present on anterior and posterior branch faces. Cyclosystems circular to elliptical, 0.9-1.4 mm in diameter. Based on 270 cyclosystems, there is a range of 7-12 dactylopores per cyclosystem, mean 9.34, and mode 9.

Gastrostyles lanceolate, up to 0.6 mm high and 0.32 mm wide ; H:W = 1.6-1.8. Lower half of style lacks spines or has only very short spines; midstyle greatly flared caused by long perpendicularly projecting spines; upper third of gastrostyle with large cylindrical spines (up to 66 µm long and 20 µm in diameter), which are directed upward (Fig. 30 F-G). Dactylotomes about 0.12 mm wide; dactylostyles robust. Pseudosepta one to two times width of dactylotome and composed of slender (20-30 µm), elongate, labyrinthine strips that are separated by very wide coenosteal slits (Fig. 30 E).

Female ampullae (Fig. 29 B) hemispherical, about 1.1 mm in diameter with an efferent pore diameter of 25-28 µm. Male ampullae (Fig. 29 C, 30 D) smaller, more irregularly shaped hemispheres, rapidly becoming internal witb a slight increase in branch diameter; apical efferent pore.

Comparisons

S. erubescens britannicus is most easily distinguished from the other subspecies by its coarse coenosteum. Other distinctive characters are its low number of dactylopores per cyclosystem, distinctively shaped gastrostyle, unusual pseudoseptal architecture, and primarily internal male ampullae.

Remarks

The name given to the new subspecies refers to its geographic distribution around the British Isles.

The earliest record of *S. erubescens britannicus* in the northeastern Atlantic (Faroes – Hebrides area) was contemporaneous with the description of the nominotypical subspecies in the western Atlantic, but this record was not duly recognized until now. In fact, *S. erubescens britannicus* is one of the 4 species from one station identified by Duncan, first (1870) as *Allopora oculina*, then (1873) as *Stylaster gemmascens* (the other species of the mixture are *S. norvegicus*, *S. gemmascens*, and *Stenohelia maderensis*).

From the literature Broch (1914a) already presumed that *S. erubescens* (incorrectly synonymized with *S. roseus*) was included under *S. gemmascens* sensu Duncan (1873), but he incorrectly quoted the corresponding illustrations from Duncan (pl. 49, fig. 13-15, instead of fig. 8-10). Broch (1914a) had not seen specimens of *S. erubescens britannicus*, all his material (reported as *S. roseus*) being the other northern subspecies, *S. erubescens groenlandicus*.

Distribution and ecology

Geographically *S. erubescens britannicus* is nearest to *S. erubescens groenlandicus*. *S. erubescens britannicus* has been confidently identified from 6 stations ranging from southeast of Iceland (64°16'N) through the Faroes – Hebrides area and the Rockall Trough to the Celtic Sea (48°37'N), depth range 350-1080 m.

Unidentified *Stylaster* from Porcupine Bank (W of Ireland) may belong here. In a sedimentological study, Scoffin & Bowes (1988: 130) mentioned *Stylaster* sp., dredged and observed from the submersible "*Cyana*". The dredged material ("*Challenger II*" 1981, stn 30, BMNH

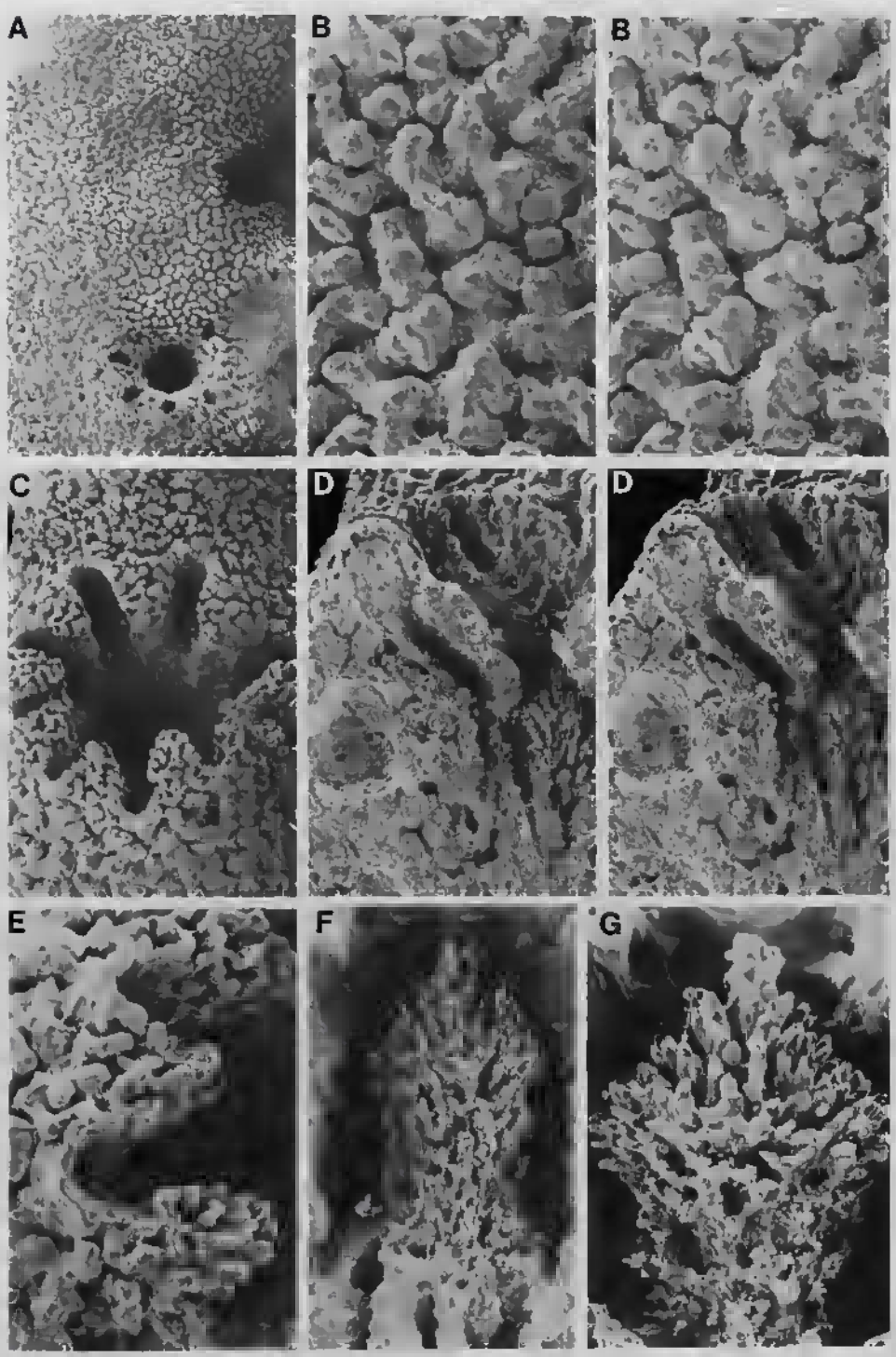

FIG. 30. — *Stylaster erubescens britannicus* (A, D, G, paratype from " *Thalassa* " z-430, MNHN; B, male paratype from " *John Murray* " site 4/dredge, BMNH 1986.11.5.1; C, E, F, paratype from " *Porcupine* " stn 54, BMNH 1880.11.13.6): A, cyclosystem and coenosteal texture (× 17); B, coenosteal texture (× 71, stereo pair); C, cyclosystem (× 30); D, longitudinal fracture through cyclosystem revealing gastrostyle and internal male ampulla (× 38, stereo pair); E, pseudosepta (× 70); F-G, gastrostyles (× 71, × 116, respectively).

1989.6.16.2-3), which consists of two highly eroded pieces of larger colonies with poor traces of cyclosystems on partly anastomosing branches, cannot be identified to the species level. The photos from the "*Cyana*" dive referred to (cruise CYAPORC, dive 8, 22.7.1986, 50°42'N, 11°07'W, 700 m) unfortunately do not show the observed stylasterid colonies.

SYMBIONTS

A branch of *S. erubescens britannicus* from the Celtic Sea ("*Thalassa*" stn z-430) shows a typical trace of *Pedicularia*.

Stylaster erubescens meteorensis new subspecies

Fig. 31 A-H, 32 A-H

TYPES

All available material from Great Meteor Seamount ("*Meteor*", "*Chain*") is given type status: a small male branch (11 mm high, 11 mm wide) with 19 cyclosystems, laterally overgrowing a pteropod shell, from "*Meteor*" stn 129/DD-94 is designated holotype (Fig. 31 E), all other specimens paratypes (see Material studied). Holotype and most paratypes deposited at ZSIM.

Type locality: "*Meteor*" cruise M 19, stn 129/DD-95, 17.2.1970, 29°59'N, 28°33'W, 290 m. Great Meteor Seamount.

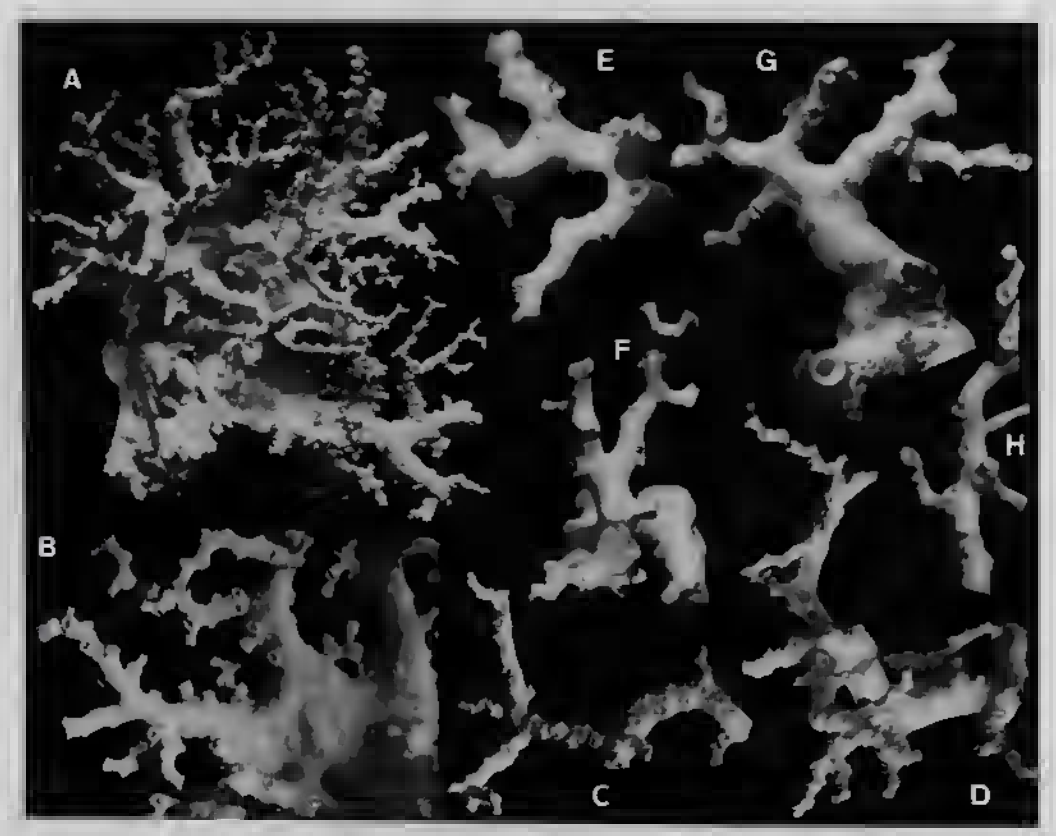

FIG. 31. — *Stylaster erubescens meteorensis* (A-D, from imprecise "*Tomiguel*" station, MNHN; E-H, from "*Meteor*" stn 129/DD-94, ZSM): A, large colony (× 0.8); B, detail from A (× 1.7); C-D, other branches (× 1.4, × 1.5, respectively); E, holotype (× 3.1); F-H, paratype colonies (× 2.3, × 2.4, × 2.2, respectively).

Material studied

Great Meteor Seamount: " *Meteor* " stn 129/DD-94, 129/DD-95, 131/DD-98, 20 small colonies and branches + minor fragments, male + female (holotype + paratypes, ZSIM). — " *Chain* " stn CH7/PD-24, small colony (paratype, USNM 75612).

Imprecise locality southwest of the Azores: said to come from seamount 260 miles (?) [475 km] southwest of Faial, ca. 500 m, fishing boat " *Tomiguel* ", coll. J.G. PEREIRA, Sept. 1976, several colonies + larger fragments, male + female (most MNHN; USNM 75611).

Description

Colonies from Great Meteor Seamount small and bushy (Fig. 31 E-H), up to 25 mm high; colonies from " *Tomiguel* " bushy (Fig. 31 A), up to 15.5 cm high and 10 cm wide. Branches slender (Fig. 31 C-D). Coenosteum white, composed of oddly shaped convex strips 65-75 µm wide. Strips highly anastomotic, forming a maze of interconnections, and characterized by symmetrical protuberances on either side of the strip (Fig. 32 B). Strips smooth (granules not present), producing a porcelaneous aspect.

Cyclosystems primarily on lateral branch edges but some occasionally present on anterior and posterior faces. Cyclosystems circular to irregular in shape, 0.9-1.2 mm in diameter (Fig. 32 A, C). Based on 206 cyclosystems, there is a range of 9-15 dactylopores per cyclosystem, a mean of 11.98, and a mode of 11.

Gastrostyles ovate, illustrated style (Fig. 32 G-H) 0.39 mm tall and 0.28 mm wide (H:W = 1.39). Style covered with extraordinarily long and often bifid spines, up to 120 µm long and 15 µm in diameter. The long closely spaced spines make the gastrostyle a very delicate structure. Dactylotomes about 0.11 mm wide; pseudoseptal width equal to or less than that of dactylotomes. Dactylostyles robust, composed of cylindrical elements up to 60 µm tall and 15 µm in diameter, arranged 3 or 4 across width of dactylostyle (Fig. 32 E-F).

Female ampullae superficial (Fig. 32 A), 0.6-0.8 mm in diameter, often with a short efferent tube leading to efferent pore, which is about 0.2 mm in diameter. Male ampullae superficial mounds 0.6-0.7 mm in diameter, each having 1 or 2 apical efferent pores 25 µm in diameter.

Comparisons

S. erubescens meteorensis is most easily distinguished from the other subspecies by its unique coenosteal texture and bushy colony shape. Other distinctive characters are its very long gastropore spines, high number of dactylopores per cyclosystem, and slender pseudosepta (Table 2).

Remarks

The name given to the new subspecies refers to its geographic distribution (Great Meteor Seamount).

Distribution and ecology

There is a wide geographic hiatus between *S. erubescens meteorensis*, the western Atlantic nominotypical subspecies, and the geographically nearest eastern Atlantic subspecies, *S. erubescens britannicus*.

The only precise locality from which *S. erubescens meteorensis* is known is the Great Meteor Seamount (300 m). The seamount (ca. 500 m) visited by the fishing boat " *Tomiguel* " could not precisely be identified with one of those situated between the Azores, the Mid-Atlantic Ridge, and Great Meteor Seamount.

No symbionts are known.

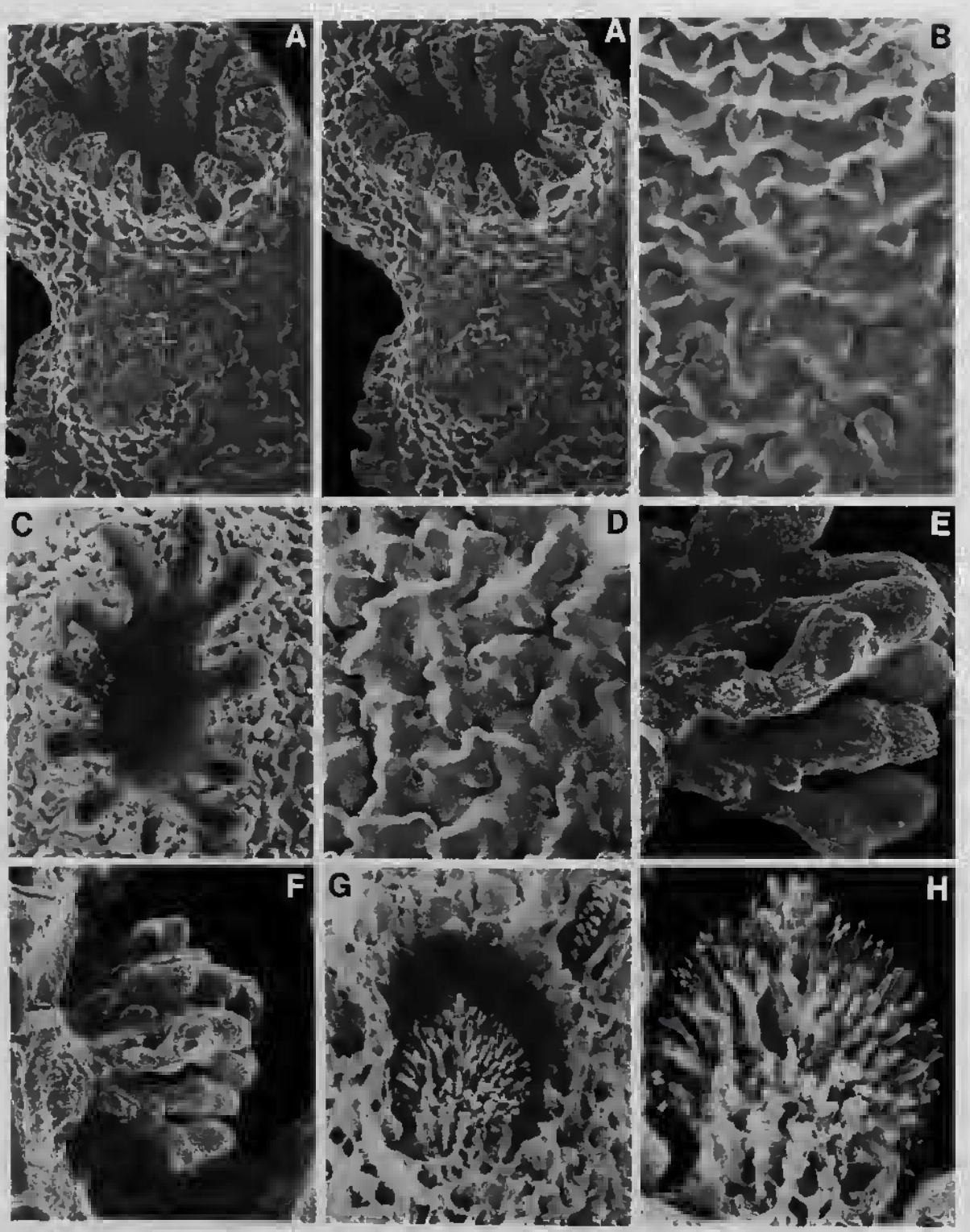

FIG. 32. — *Stylaster erubescens meteorensis* (A, D, female paratype from imprecise "*Tomiguel*" station, USNM 75611; B-C, E-H, male paratype from "*Meteor*" stn 129/DD-95, ZSM): A, cyclosystem and female ampulla (× 32, stereo pair); B, D, coenosteal texture (× 88, × 92, respectively); C, cyclosystem (× 36); E-F, dactylostyle viewed end-on, from above cyclosystem (× 745, × 418, respectively); G, gastrostyle and dactylostyle (× 62); H, gastrostyle (× 124).

Genus *STENOHELIA* Saville Kent, 1870

Diagnosis. — Gastro- and dactylopores arranged in cyclosystems, which occur exclusively on anterior branch face. Cyclosystems without lips or lids. Coenosteum white or light brown, either linear-imbricate or reticulate-granular in texture. Gastropores long and usually curved; gastrostyles present, usually encircled by a robust ring palisade. Dactylostyles rudimentary. Ampullae superficial, often clustered around base of cyclosystem. Ampullar efferent pores of both sexes usually well distinguished.

Type species: *Allopora maderensis* Johnson, 1862, from Madeira.

Genus represented in the study area by the type species and a poorly known form (unnamed) that appears to be a distinct species.

Stenohelia maderensis (Johnson, 1862)

Fig. 33 A-L, 34 A-J

Synonymy:

Allopora maderensis Johnson, 1862: 196, fig. 1-3.

Chresonymy:

Stenohelia maderensis — Saville Kent, 1870: 120; 1871: 277, pl. 24, fig. 3, 3a-c. — Boschma, 1957a: 31-32; 1964b: 64-65, 67, 68, 71, 72 (part: only eastern Atlantic), text-fig. 1a-g; 1964d: 80-84 (part: only eastern Atlantic); 1967: 325-329 (part: only eastern Atlantic), text-fig. 2a-b, pl. 1, fig. 3-4, pl. 2, fig. 3-4, pl. 2, fig. 3-4; 1968d: 437, 438 (part: only eastern Atlantic). — Cairns, 1983b: 431, 487-489, fig. 20 A-B, D-G.
Allopora madeirensis — Studer, 1878: 633; 1879: 676.
Stylaster madeirensis — Moseley, 1879: 481.
Stenohelia madeirensis — Moseley, 1879: 503; 1881: 88. — Greeff, 1886: 20. — Studer, 1889: 6-7.
Allopora oculina — Duncan, 1870: 290, 295 (part).
Stylaster gemmascens — Duncan, 1873: 332 (part), pl. 49, fig. 13-15.
Stylaster tiliatus — Hickson, 1912b: 461.

Types

Allopora maderensis: According to Johnson (1862) the unique figured colony (considered the holotype) on which the description was based was 89 mm high and 57 mm wide. Although the BMNH was indicated as depository, the specimen could not be found there and may be lost. A smaller colony (51 mm high, 29 mm wide) at the BMNH (1872.6.26.7, Madeira, J.Y. Johnson) registered as Johnson's type does not correspond to the larger holotype as previously figured, and may be a later acquisition from Johnson; it is here designated the neotype (Fig. 33 A). Fragment of the neotype USNM 75625.

Type locality: Madeira. No additional indications in Johnson's text.

Material studied

Between Faroes and Hebrides: " *Porcupine* " stn 54, 2 small branches (BMNH 1880.11.13.10-11).

S Bay of Biscay — NW Spain: " *Thalassa* " stn T-503, small branch; stn X-340, fragment; stn X-341, 3 fragments; stn X-342, fragment; stn X-347, 3 fragments; X-352, 3 fragments; stn X-353, 5 fragments; stn X-362, 14 fragments; stn X-363, 7 fragments; stn Y-434, fragment (all MNHN). — Off Cabo Peñas 43°58.06'N, 5°43.95'W, 769 m (stn H-5), C. Alvarez-Claudio, 10 small colonies and branches (USNM 85078).

Galicia Seamount: " *Noroit* " 1987, cruise SEAMOUNT 1 stn DW-108, 85 pieces, mainly branch

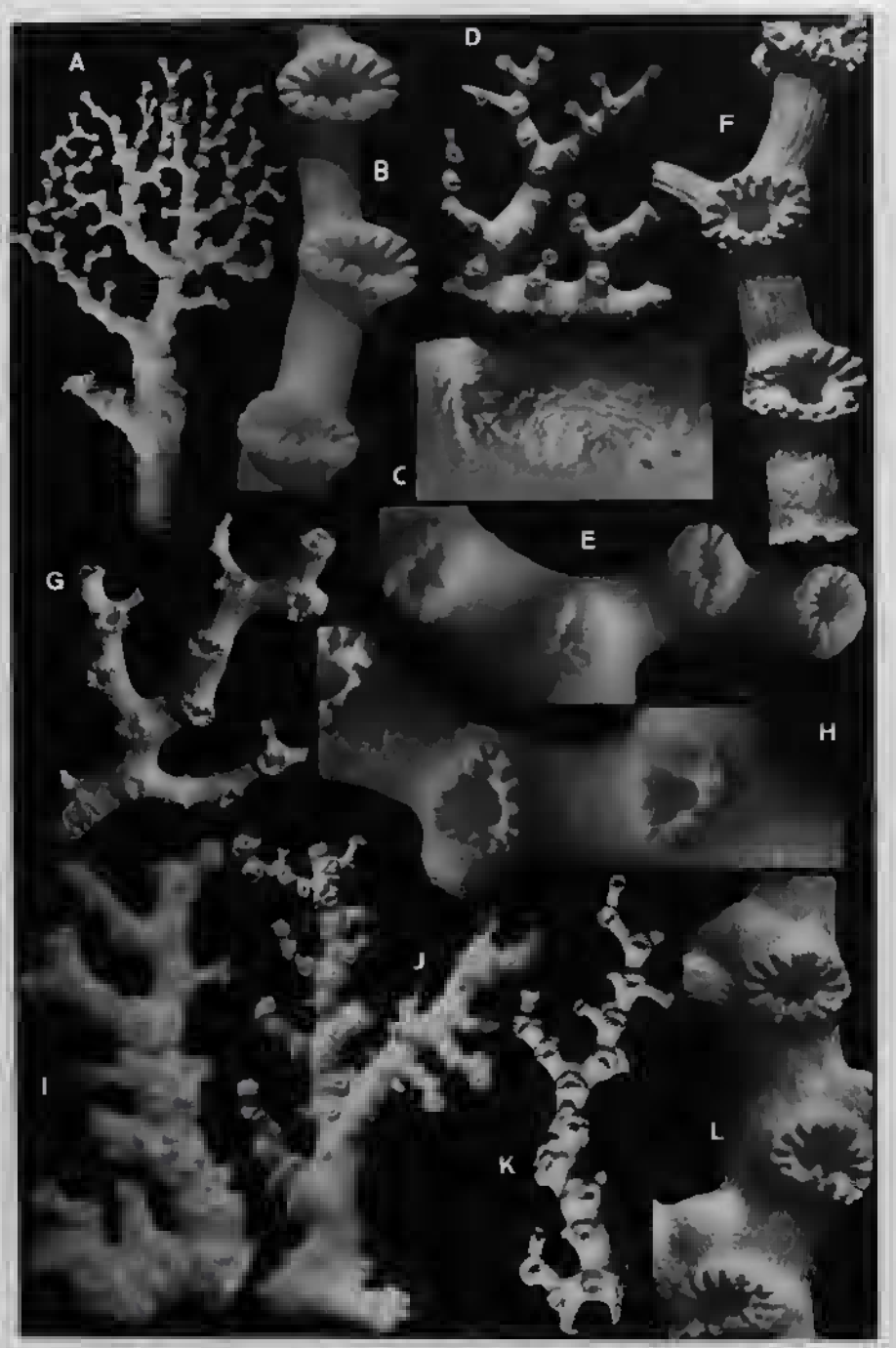

FIG. 33. — *Stenohelia maderensis* (A-C, from Madeira, BMNH 1872.6.26.7; D-E, from Madeira, BMNH 1873.7.9.6; F, from "*Jean Charcot*" 1966, stn 29, MNHN; G-H, from "*Thalassa*" T-503, MNHN; I, from "*Porcupine*" stn 54, BMNH 1880.11.13.10-11; J, from "*Talisman*" drag. 103, MNHN; K-L, from "*Gazelle*" stn 2, ZMB 1772): A, neotype (× 1.3); B, branch segment of neotype with three cyclosystems (× 18); C, *Pedicularia* trace on neotype (× 20); D, small incomplete colony (× 2.3); E, branch segment of D with four cyclosystems (× 15); F, branchlet illustrating cyclosystems (× 15); G, small colony (× 3.8); H, detail of G with gastrostyle visible in gastropore (× 14); I, colony with clustering female ampullae (× 3.5); J, colony with clustering female ampullae (× 3.2); K, branch (× 2.9); L, detail of K with ampullae near cyclosystems (× 14).

fragments with 1 to 6 cyclosystems, and a few tiny colonies with up to 3 cyclosystems (MNHN; USNM 88326); stn DW-116, tiny colony with 3 cyclosystems (MNHN).

Madeira Archipelago: Neotype. — Madeira, R.T. LOWE, colony (BMNH 1873.7.9.6). — "*Gazelle*" stn 2, 2 branches (ZMB 1772). — "*Jean Charcot*" 1966, stn 21, 7 fragments (MNHN); stn 29, 12 fragments (MNHN); stn 49, dead fragment (MNHN).

Cape Verde Islands: "*Talisman*" drag. 103, ca. 60 colonies, branches, fragments (most MNHN; branch USNM 75627; branch BMNH 1950.1.11.81). — "*Calypso*" 1959, stn 16, 4 branches (MNHN); stn 91, ca. 20 branches + fragments (most MNHN; 3 branches USNM 75626).

DESCRIPTION

Colonies uniplanar (Fig. 33 A, D, I-K), largest specimen known (JOHNSON's holotype of *Allopora maderensis*) 89 mm high and 57 mm wide; another incomplete colony 66 mm wide. Branches with inversed unifaciality of cyclosystem arrangement occasionally occur. Branches cylindrical and delicately branched, tapering to branch tips equalling diameter of cyclosystem. Coenosteum white, linear-imbricate in texture (Fig. 34 G). Strips 75-100 µm wide, bordered by deep continuous slits about 10 µm wide (Fig. 34 F). Platelets broad and corrugated, extending across width of strip. Coenosteal papillae occur on posterior face of some specimens.

Cyclosystems elliptical to irregular in shape (Fig. 33 B, E-F, H, L, 34 E), with greater axis perpendicular to branch axis. A typical gastropore measures 1.1 x 0.85 mm in diameter. Based on 727 cyclosystems, there is a range of 8-20 dactylopores per cyclosystem, mean 14.61, and mode 14. The component data for each of the 5 areas included are: Madeira Archipelago, 179 cyclosystems (from 5 stations), range 12-20, mean 14.80, and mode 15; Cape Verde Islands, 326 cyclosystems (from 3 stations), range 11-20, mean 14.75, and mode 14; Galicia Seamount, 89 cyclosystems ("*Noroit*" 1987, cruise SEAMOUNT 1 stn DW-108), range 8-20, mean 14.29, and mode 15; south of Bay of Biscay, 87 cyclosystems (off Cabo Peñas), range 11-18, mean 14.46, and mode 15; Faroes – Hebrides area, 46 cyclosystems ("*Porcupine*" stn 54), range 12-16, mean 13.70, and mode 14. As observed on material from Galicia Seamount, tiny colonies may have regular cyclosystems with a particularly low number of dactylopores.

Gastropores deep and curved, but gastrostyle tip always visible in undamaged cyclosystem (Fig. 33 H). Diffuse ring palisade at level of gastrostyle tip composed of irregularly shaped elements up to 43 µm in diameter and 60 µm tall, but elements more commonly only about 15 µm in diameter. Gastrostyle conical (Fig. 34 B-C), up to 0.40 mm tall and 0.16 mm in diameter, with H:W ratios ranging from 2.5-3.6. Style slightly ridged and very spinose, the long slender spines up to 55 µm long. Dactylotomes about 80 µm wide; pseudosepta one to two times dactylotome width; no diastemas. Dactylostyle composed of a row of cylindrical to clavate elements up to 46 µm tall and 14 µm in diameter (Fig. 34 D).

Female ampullae hemispherical (Fig. 33 I, 34 J), 0.70-0.85 mm in greater diameter, with 1 or 2 efferent pores, each 0.16-0.18 mm in diameter. Binary ampullae are elongate (elliptical in cross section), with one efferent pore occurring at each of the vertices. Male ampullae (Fig. 34 H-I) slightly less prominent superficial mounds 0.45-0.60 mm in diameter, with 1-3 apical efferent pores, each about 40 µm in diameter. Male ampullae often occur on posterior face opposite cyclosystems, whereas female ampullae are usually clustered on anterior face near a cyclosystem, often with their efferent pores directly adjacent to cyclosystems.

COMPARISONS

Of the 11 valid species of *Stenohelia* (see CAIRNS, 1983b, 1986a), 3 occur in the Atlantic. The western Atlantic *S. profunda* Moseley, 1881, and *S. pauciseptata* Cairns, 1986, are discussed and compared to *S. maderensis* by CAIRNS (1986a). To reiterate, *S. maderensis* differs from *S. profunda* by having a lower average number of dactylopores per cyclosystem, a shorter gastropore tube (allowing

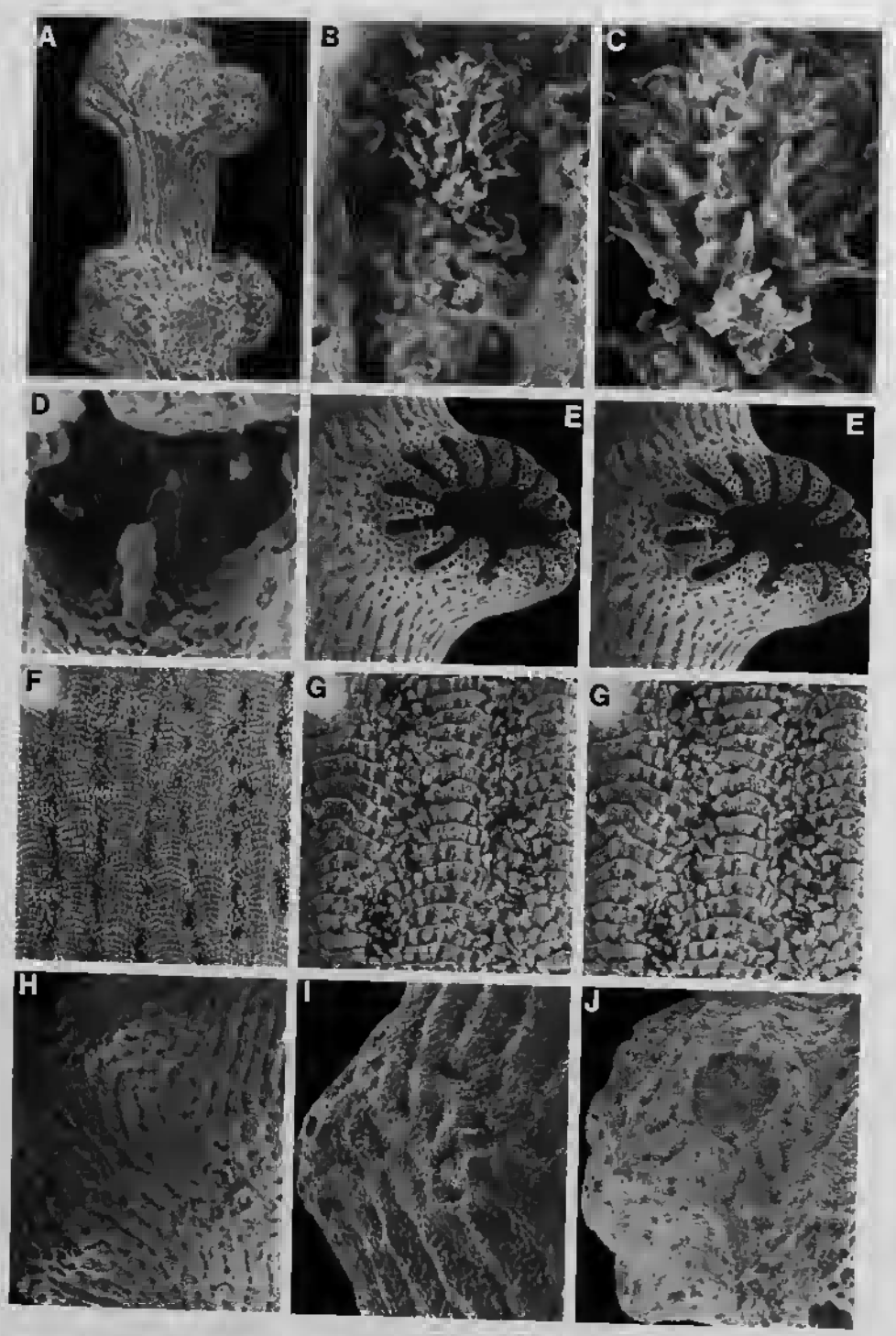

FIG. 34. — *Stenohelia maderensis*. — (A, D, J, female from "*Talisman*" drag. 103, BMNH 1950.1.11.81; B-C, H-I, male from "*Talisman*" drag. 103, BMNH 1950.1.11.81; E-G, male neotype fragment, USNM 75625): A, branch tip bearing four female ampullae (× 19); B-C, gastrostyle (× 83, × 167, respectively); D, dactylostyle (× 358); E, cyclosystem (× 26, stereo pair); F-G, coenosteal texture (× 65, × 183, respectively, G being a stereo pair); H, three male ampullae, each with two or three efferent pores (× 29); I, male ampullae with two efferent pores (× 78); J, female ampulla with efferent pore (× 68).

a view of the gastrostyle tip), smaller cyclosystems, and rugose ampullae. It differs from *S. pauciseptata* by having a higher average number of dactylopores per cyclosystem, a smaller H:W ratio, much larger gastrostyle spines, and larger ampullae.

Remarks

On the basis of Johnson's (1862) holotype from Madeira, Saville Kent (1870) emended the species description and erected the genus *Stenohelia*. Studer (1878, 1879, 1889) reported a new record from Madeira, and Saville Kent (1871) and Greeff (1886) new records from the Cape Verde Islands. Boschma (1964b) analyzed the descriptions by Johnson (1862) and Saville Kent (1870, 1871) and reproduced the figures contained in these papers.

By error, Hickson (1912b) referred material from the Cape Verde Islands (" *Talisman* ") to *Stenohelia tiliata* (Hickson & England, 1905), a species based on material from the Sulu Islands (southern Philippines). That misidentification was corrected by Boschma (1967), who examined Hickson's material and concluded that it was typical *S. maderensis*.

Although he had access to authentic *S. maderensis* from the eastern Atlantic, Boschma (1964b, 1964c, 1964d, 1967, 1968d) incorrectly included under *S. maderensis* a different species from the West Indies (well figured by him 1964b: pl. 1, fig. 13-14; 1964d, text-fig. 1a-c, pl. 2, fig. 1-4). As pointed out by Cairns (1986a), the western Atlantic species in question is *S. profunda* Moseley, 1879.

Boschma frequently used average numbers of dactylopores per cyclosystem and proportions of gastropore tube and gastrostyle in species diagnosis. It is therefore surprising that he did not take into account as significant the remarkably different values characerizing the eastern and western Atlantic *Stenohelia*. In one of Boschma's papers (1968d), *S. maderensis* (with an average of 13.50 dactylopores per cyclosystem) is said to come from the Azores. This was a lapsus; in fact, the material in question came from the Cape Verde Islands (" *Talisman* "; previously mentioned by Hickson, 1912b, under *S. tiliatus*).

Unfortunately, the holotype of *S. maderensis*, as characterized and figured by Johnson (1862), was not available for the present study, and additional material from Madeira is scarce: 2 small colonies at the BMNH (including designated neotype (Fig. 33 A-B); 2 small branches from the " *Gazelle* " expedition (Fig. 33 K-L); and a few small fragments collected by the " *Jean Charcot* " in 1966 (Fig. 33 F). These specimens appear conspecific with Johnson's missing holotype, and are herein considered as topotypic.

Material is much more abundant from the Cape Verde Islands and includes pieces from larger colonies (originally exceding 10 cm ?). Only small fragments (all dead, the largest comprising 11 cyclosystems) are available from the " *Thalassa* " stations off northwestern Spain and in the south of the Bay of Biscay (all sorted out from sediment samples) but live colonies up to 25 mm high and 30 mm wide are known from 2 stations off Cabo Peñas (cruises COCACE of the University of Oviedo in 1987; part of material studied here, the other station being 43°56.50'N, 5°48.90'W, 893 m; C. Alvarez-Claudio, *in litt.* 1990).

S. maderensis is one of the 4 species from between the Faroes and the Hebrides confused by Duncan, first (1870) as *Allopora oculina*, then (1873) as *Stylaster gemmascens* (the other species are *S. gemmascens*, *S. norvegicus*, and *S. erubescens britannicus*).

Distribution and ecology

S. maderensis is known from between the Faroes and the Hebrides (665 m; one old record; presence in the area to be confirmed), northwestern Spain and the south of the Bay of Biscay (490-910 m), Galicia Seamount (985-1125 m), Madeira Archipelago (depth recorded from 4 stations, 110-500 m; dead fragments from the deeper stations), and the Cape Verde Islands (150-400 m). This is a wide geographical range (from about 15°N to 60°N) and a wide depth and temperature range (ca. 7-15°C). The shallowest records are 110-128 m at Madeira, and 150 m in the Cape Verde Islands; the deepest

occurrences in the Bay of Biscay and on Galicia Seamount, comprising live specimens, appear correctly recorded. Greater depths are linked with higher latitudes, which would seem to be an anomaly.

In the Cape Verde Islands *S. maderensis* occurs together with the precious scleraxonian gorgonian *Corallium rubrum*. In 1883 the "*Talisman*" obtained abundant material of the stylasterid from several dredge hauls (150-275 m) in the area off São Tiago where the precious coral was commercially fished at that time (cf. ZIBROWIUS, MONTEIRO MARQUES & GRASSHOFF, 1984). GREEFF (1886), who in other papers reported on the red coral from the Cape Verde Islands, received a colony of *S. maderensis* at São Tiago, most likely from red coral fishermen. *S. maderensis* and *Corallium rubrum* have again been dredged together in the Cape Verde Islands by the "*Calypso*" in 1959 between Maio and Boavista (185 m).

A tiny fragment of *Stenohelia*, probably *S. maderensis*, is known from the Lower Pleistocene of Sicily (see Records of fossil stylasterids from Europe).

SYMBIONTS

In the Madeira Archipelago, *S. maderensis* is the host of *Pedicularia*. JOHNSON (1862) already noticed this association (2 specimens of the symbiont reported from the holotype colony). The neotype (BMNH 1872.6.26.7), another old colony from Madeira (BMNH 1873.7.9.6), and a small branch ("*Jean Charcot*" 1966, stn 29) each have one distinct trace of *Pedicularia* (Fig. 33 C).

Stenohelia sp. A

Fig. 35 A-H

MATERIAL STUDIED

Azores: "*Jean Charcot*" 1971, cruise BIAÇORES unknown station, small male colony now broken into 6 branches and fragments (most MNHN; 1 fragment USNM 77126).

DESCRIPTION

The only small colony available was irregular in shape, not uniplanar as typical *Stenohelia* colonies known so far, the deformation being due to the presence of a gall-tube induced by a polynoid polychaete. The colony has been broken in order to extract the polychaete; resulting fragments (Fig. 35 F-H) up to 25 mm tall, highly modified by cavernous polychaete tube. Individual branches with cyclosystems on anterior face only (Fig. 35 F), as typical for *Stenohelia*.

The coenosteum is linear-imbricate (Fig. 35 C-D) covered by broad flat corrugated platelets, but along the midline of every third or fourth strip is a prominent ridge or row of blunt spines, producing a distinctive carinate branch texture (Fig. 35 A). Cyclosystems are about 1.1 mm in diameter. Based on 62 cyclosystems, there is a range of 11-18 dactylopores per cyclosystem, mean 14.18, and mode 15. Male ampullae (Fig. 35 A-B) are large, about 0.8 mm in diameter, and covered with tall blunt spines; 1-3 apical efferent pores occur on each ampulla, each about 60 µm in diameter.

COMPARISONS

Stenohelia sp. A differs from *S. maderensis* primarily in its unusual carinate coenosteum and large spiny male ampullae. Commensal relationship with a polynoid polychaete may also be a distinctive character.

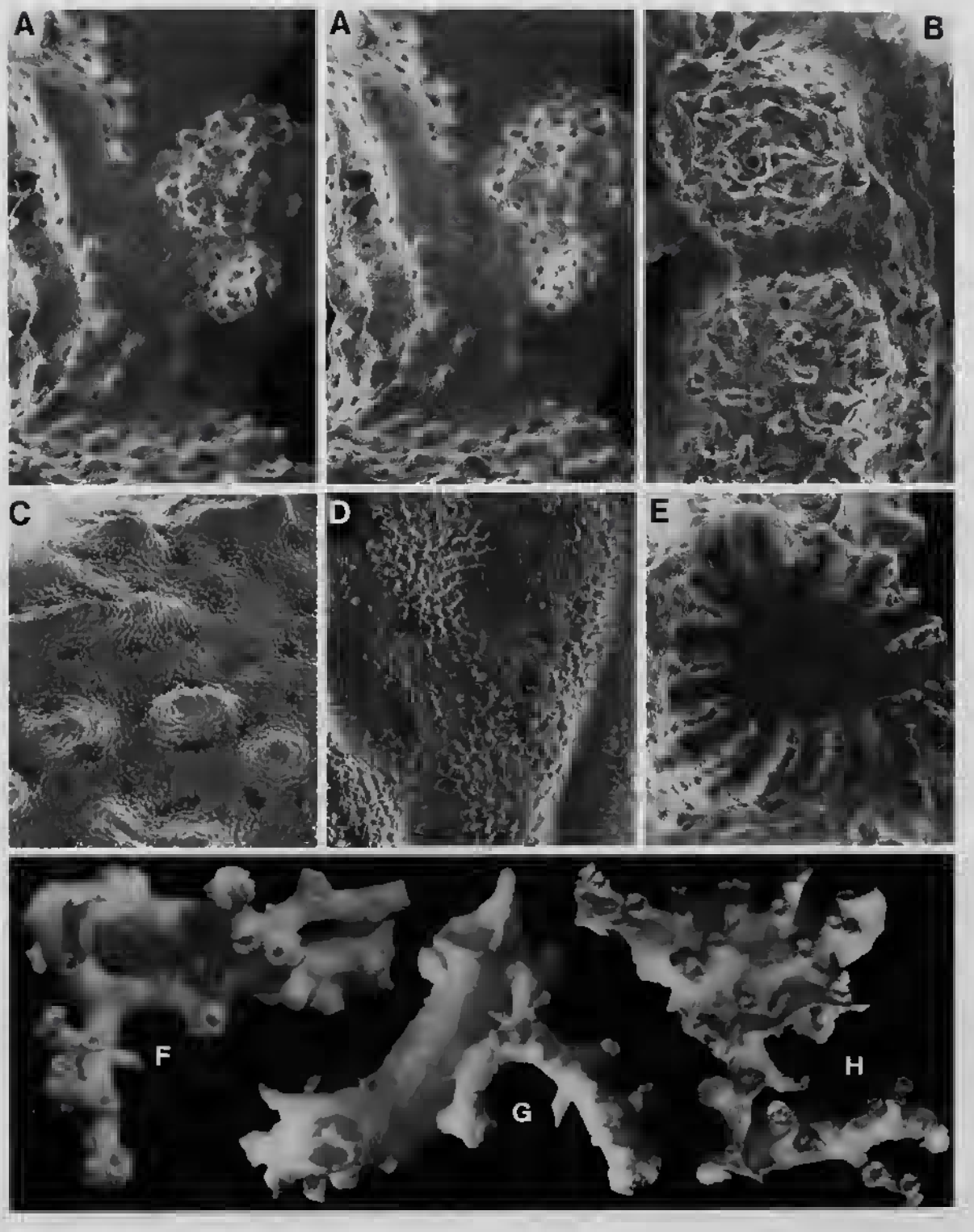

FIG. 35. — *Stenohelia* sp. A (A-H, male from "*Jean Charcot*" 1971, unknown station, Azores, MNHN): A, branch fragment illustrating coenosteal ridges and male ampulla (× 33, stereo pair); B, two male ampullae with efferent pores (× 37); C-D, coenosteal texture (× 80, × 150, respectively); E, cyclosystem (× 35); F-H, three fragments of original colony; G, illustrating gall tube induced by polynoid polychaete (× 3.7, × 3.7, × 2.9, respectively).

REMARKS

The form documented here is not identified as *S. maderensis*, but not enough material is present to justify the description as a new species.

DISTRIBUTION AND ECOLOGY

A single colony from the Azores, unknown locality and depth (bathyal).

SYMBIONTS

The single colony is deformed by a gall-tube (Fig. 35 G) induced by a polynoid polychaete (*Harmothoe* sp.).

Genus *CRYPTHELIA* Milne Edwards & Haime, 1849

Diagnosis. — Gastro- and dactylopores arranged in cyclosystems, which usually occur exclusively on anterior branch face. Cyclosystems partially or entirely covered by one or more fixed lids. Coenosteum white or light brown, linear-imbricate in texture, and often spinose as well. Nematopores usually present, especially on cyclosystem lids, pseudosepta, and ampullae. Gastropore double-chambered; no gastro- or dactylostyles. Ampullae usually superficial and large, occurring in various positions and with a variety of efferent pore locations. CAIRNS (1986b) described 3 female ampullar types and 8 male ampullar types, for 24 possible permutations; however only 9 combinations (not 12 as reported by CAIRNS, 1986b), have been discovered thus far: A-A1, A-A2, A-C4, B-B, B-C1, B-C2, B-C3, B-C4, C-D (as shorthand notations these are called ampullar formulae).

Type species: *Crypthelia pudica* Milne Edwards & Haime, 1849, from the western Pacific.

Genus represented in the study area by 4 species.

Crypthelia affinis Moseley, 1879

Fig. 36 A-I, 37 A-I

Synonymy:

Cryptohelia affinis Moseley, 1879: legend on pl. 42.
Cryptohelia moseleyi Hickson & England, 1905: 21.

Chresonymy:

Cryptohelia pudica - MOSELEY, 1876a: 548, 557 (part: 2798 m); 1879: 462-467, 482 (part: 2798 m), pl. 35, fig. 7, pl. 42 (with legend on plate *Cryptohelia affinis*), pl. 44, fig. 1, 3-8; 1881: 71-76, 82-83, 88 (part: "*Challenger*" stn 3, 2790/2798 m), pl. 2, fig. 7, pl. 9 (with legend on plate *Cryptohelia affinis*); pl. 11, fig. 1, 3-8, pl. 12, fig. 7. — THOMSON, 1877: vol.1, 271 (part: "*Challenger*" stn 3, 2790 m), fig. 65.
Cryptohelia affinis — MOSELEY, 1881: legend on pl. 9.
Crypthelia affinis - BOSCHMA, 1951b: 455-456; 1953c: 171-172; 1956b: F100, fig. 81.2; 1957a: 34; 1968a: 106 (part: NOT "TALISMAN"). — CAIRNS, 1983b: 431; 1986b: 24-25.
Crypthelia moseleyi — FISHER, 1938: 534. — BROCH, 1936: 94.

TYPES

Cryptohelia affinis: There is no original description, strictly speaking. The name *C. affinis* appears only on a plate published twice (MOSELEY, 1879, 1881) and is not used in the corresponding explanation or in the text, where the figured stylasterid (from "*Challenger*" stn 3) is incorrectly ascribed to *Cryptohelia pudica* Milne Edwards & Haime 1849. Since MOSELEY's species is different,

it has to be designated by the first available name. *C. affinis* Moseley, 1879, fullfills this condition, since this name is clearly associated with an illustration in which the species is recognizable.

Moseley (1879, 1881) did not indicate the number of specimens from " *Challenger* " stn 3, but 6 branches (5 collected alive, 1 dead) and some smaller fragments, here considered as syntypes (part of them figured herein, Fig. 36 F-G), are preserved at the BMNH (1880.11.25.188). The largest of the live pieces (45 mm high, 16 mm wide, 40 cyclosystems) was part of the larger piece figured by Moseley (1881, pl. 12, fig. 7) and together with another branch (20 cyclosystems) was part of the colony figured by Thomson (1877: vol. 1, fig. 65; erroneously referred to stn 23).

Type locality: " *Challenger* " stn 3, 18.2.1873, 25°45'N, 20°12'W, 2790 m. Far southwest of the Canary Islands. Locality and depth doubtful (see below Distribution and ecology).

Crypthelia moseleyi: Hickson & England (1905) were right in considering *Crypthelia pudica* sensu Moseley (as described and figured from " *Challenger* " stn 3) as a distinct species. Being not aware of the availibility of *affinis*, they proposed the name *moseleyi*. The latter thus is an objective synonym of the former, each being based on the same name-bearing type material.

Material studied

SW Canary Islands: syntypes of *Cryptohelia affinis* (see above).

Azores: Prince of Monaco stn 203, dead branch (MOM); stn 233, 4 dead branches + fragments (MOM). — " *Jean Charcot* " 1971, cruise BIAÇORES stn 25, dead branch (MNHN); stn 74, colony + fragment (MNHN); stn 102, dead colony (MNHN); stn 112, 5 colonies + branches (most MNHN; USNM 75624); stn 135, dead branch (MNHN); stn 180, 7 colonies + branches + fragments (MNHN); unknown station, dead female colony (MNHN).

Description

Colonies uniplanar, up to 53 mm high and 79 mm wide (Fig. 36 A-F). Branch anastomosis common. Branches with inversed unifaciality of cyclosystem arrangement occasionally occur (Fig. 36 B). Coenosteum primarily linear-imbricate (Fig. 37 F-G), becoming reticulate-imbricate near cyclosystems and on ampullae (Fig. 37 D). Strips 75-90 µm wide, covered by coarse, irregularly shaped platelets, producing a rough microtexture. Nematopores randomly scattered over branch coenosteum, pseudosepta, ampullae, and lids; nematopores about 65 µm in diameter.

Cyclosystems circular to slightly elliptical in shape, 1.4-1.8 mm in diameter (Fig. 36 G-H). Based on 88 cyclosystems from the syntypes (" *Challenger* " stn 3) there is a range of 12-18 dactylopores per cyclosystem, mean 14.51, and mode 15; based on 341 cyclosystems from specimens from the Azores (9 stations) the range is 12-22, mean 16.26, and mode 17.

Maximum width of upper gastropore chamber about 0.65 mm, which narrows to a gastropore ring constriction of about 0.50 mm in diameter. Lower chamber (Fig. 37 H) about 0.9 mm in greatest diameter and about 0.1 mm deep. Cyclosystem lid tongue-shaped and horizontal, covering 50-100 % of cyclosystem when viewed from above. Intact lid approximately 1 mm wide and quite thin in male colonies (Fig. 37 B) but invariably inflated in mature female cyclosystems (Fig. 37 C). Dactylotomes about 75 µm wide; pseudosepta of equal width and concave.

Each female cyclosystem has an ampulla consisting of a large swelling in proximal cyclosystem wall (Fig. 37 C), which often extends into lid and partially around the cyclosystem. Efferent pore circular and quite large (0.35 mm in diameter), occurring on lower wall of upper gastropore chamber in proximal cyclosystem region. Male ampullae consist of 1-5 less conspicuous swellings that encircle cyclosystem. Male ampullae most common on proximal cyclosystem wall adjacent to lid (Fig. 37 D). Each male ampulla bears a large apical steep sided concavity 0.20-0.25 mm in diameter, the center of which is an efferent pore about 45 µm in diameter. According to the classification of Cairns (1986b), the ampullar formula is B-C1, the most common of the nine known combinations, shared by five other species.

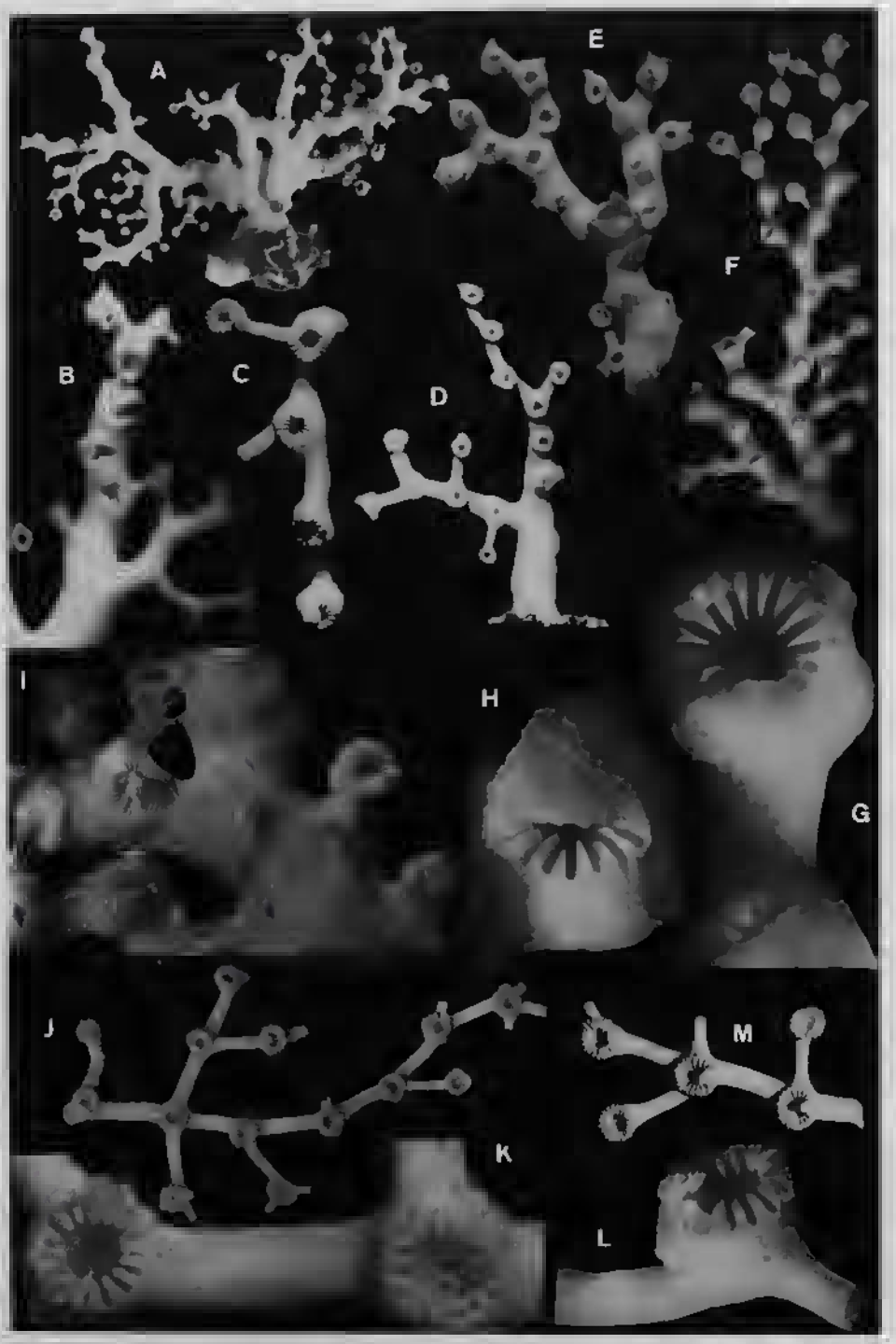

FIG. 36. — *Crypthelia affinis* (A, from " *Jean Charcot* " 1971, stn 74, MNHN; B-D, from " *Jean Charcot* " 1971, stn 112, MNHN; E-H, syntypes of *C. affinis*, BMNH 1880.11.25.188; I, from Prince of Monaco stn 233, MOM): A, colony (× 0.7); B, branch illustrating alternation of unifaciality of cyclosystem arrangement (× 2.4); C, branch (× 3.6); D, colony (× 1.8); E-F, colony fragments (× 2.0, × 1.6, respectively); G, syntype cyclosystem having lost the lid (× 15); H, syntype cyclosystem with lid intact (× 15); I, part of massive dead colony (× 3.6).

Crypthelia medioatlantica (J-L, holotype, ZMUK; M, paratype, MOM): J, colony still with soft tissues (× 2.8); K-L, branch segments of J with cyclosystems having lost their lids (both × 13); M, branch (× 4.8).

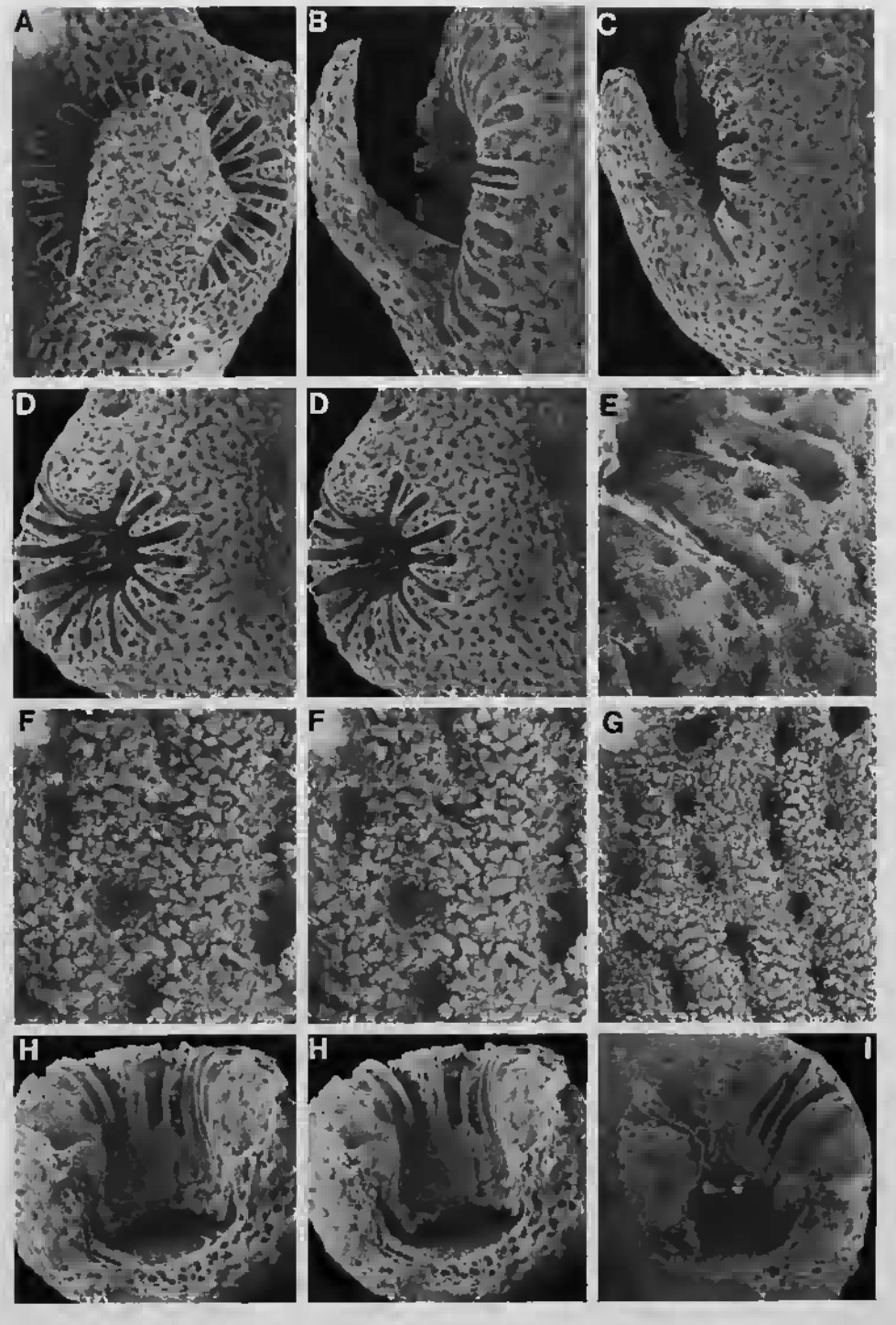

FIG. 37. — *Crypthelia affinis* (A-B, D, F-H, male from " *Jean Charcot* " 1971, unknown station, Azores, MNHN; C, E, I, female from " *Jean Charcot* " 1971, stn 112, USNM 75624): A-B, male cyclosystem viewed from above and from side (× 21, × 33, respectively); C, side view of female cyclosystem (× 35); D, male cyclosystem with broken lid, two efferent pore depressions in upper right (× 20, stereo pair); E, pseudosepta (× 75); F-G, coenosteal texture (× 148, × 97, respectively, F being a stereo pair); H, longitudinal section of male cyclosystem showing gastropore chambers (× 26, stereo pair); I, longitudinal section of female cyclosystem showing gastropore chambers and large efferent pore (× 19).

	C. affinis	*C. medioatlantica*
coenosteum: width + relief of strips; width of platelets	75-90 µm, sligthtly convex; platelets irregularly shaped, coarse	70-85 µm, sligthtly convex; narrow platelets (4-14 µm)
nematopores: size; location	65 µm, random on coenosteum, ampullae, lid, pseudosepta	absent
cyclosystem: average size and shape	1.4-1.8 mm, circular to slightly elliptical	1.2-1.4 mm, circular
dactylopores per cyclocystem: range mean, mode (N)	12-22, 16.54, 16 (420)	14-19, 15.86, 15 (22)
cyclosystem lid: shape; % cover of cyclosystem; inclination	tongue-shaped; 50-100 %; horizontal	digitiform; 0-20 %; inclined
pseudosepta: width relative to dactylostomes; concavity	esqual; concave	esqual; very concave
ampullar formula (see Cairns, 1986b and text)	B-C1	?-C1 (female ampullae unknown)
other diagnostic characters	female efferent pore opens quite low in gastropore chamber	male ampullae carinate

Comparisons

Within the Atlantic, *C. affinis* is most similar to *C. medioatlantica* and is compared to that species in the account of the latter and in Table 3.

Remarks

Samples of several species of *Crypthelia* collected by the " *Challenger* " at 4 stations (stn 3, Canary Islands, 2790 m; stn 24, West Indies, 713 m; stn 171, Kermadec Islands, 1097 m; stn 236, Japan, 1417 m) were all referred by Moseley (1876a, 1879, 1881) to *C. pudica*. Moseley's (1879, 1881) detailed descriptions and illustrations of what he believed to be *C. pudica* were based on the more abundant material from stn 3, part of which had been collected alive and provided the soft parts for an exemplary anatomical study.

A lapsus occurred in the sentence indicating the origin of the material (Moseley, 1879: 462; 1881: 71): " The specimens, the anatomy of which is here described, were dredged off the mouth of the La Plata ". This should read " off the Canary Islands ". In fact, Moseley did study the anatomy of other stylasterid species dredged at " *Challenger* " stn 320, in the Southwest Atlantic off the mouth of the Rio de la Plata, but no *Crypthelia* had been obtained there. In addition to the anatomical structures of the soft parts, Moseley figured a branch of the coral, the origin of which is clearly indicated in the explanation as being the Canary Islands station (Moseley, 1881: 226, pl. 12, fig. 7).

Throughout his text, Moseley (1879, 1881) uses the name *C. pudica*, but on a plate (pl. 42 of 1879, reprinted as pl. 9 of 1881) showing the anatomy of the soft parts, the name *C. affinis* occurs. In all probability, Moseley at first was convinced that the *Crypthelia* from the Canary Islands station belonged to a species different from *C. pudica* (the latter described from the West Pacific and type of the genus *Crypthelia*), and accordingly intended to name it *C. affinis*, whereas later he concluded that the Canary Islands material was conspecific with the type species. After his change of opinion the name *C. affinis* was superfluous, but already engraved on the plate and was not corrected.

C. vascomarquesi	*C. tenuiseptata*
120 µm, slightly convex; broad (up to 68 µm) + flat	250-350 µm, convex to carinate; broad + flat or irregular around cyclosystem
85-120 µm; random on coenosteum, ampullae, lid + upper outer pseudosepta	220 µm; random on coenosteum and lid edge
2.1-2.6 mm, circular to elliptical	3.8 mm, circular to irregular
14-23, 19.38, 21 (47)	15-27, 19.75, 19 (529)
tongue-shaped; 30-40 %; horizontal + concave	tongue-shaped; 60-90 %; horizontal + concave
narrow (1/4 dactylotome width); sligthly concave	narrow (1/2 dactylotome width); not concave
B(?)-C4 + A2	A-C4 + A1
	female efferent pore enormous

TABLE 3. — Comparisons of eastern Atlantic *Crypthelia*

HICKSON & ENGLAND (1905) were convinced that the species described in detail by MOSELEY was not *C. pudica*, and therefore renamed it *C. moseleyi*. In fact, it must bear the name *C. affinis*, which had already been ressurected by BOSCHMA (1951b) and subsequently used by him in other papers.

BOSCHMA (1956b) reproduced (partly) a figure from MOSELEY (1881: pl. 12, fig. 7) but erroneously indicated the distribution of *C. affinis* as the West Indies. Later (BOSCHMA, 1968a), when mentioning *C. affinis* as a distinct species of the eastern Atlantic, he mistakenly included material from " *Talisman* " drag. 128 (MNHN), which, in fact, is referable to *C. tenuiseptata* and *C. vascomarquesi*.

DISTRIBUTION AND ECOLOGY

C. affinis has been obtained from several stations in the Azores, depth 712-1557 m. Specimens were alive as deep as 1300 m.

According to MOSELEY (1879, 1881) the types of *C. affinis* (including live material) came from " *Challenger* " stn 3, far southwest of the Canary Islands, at a depth of 2790 m. This is the greatest depth ever recorded in the literature for a stylasterid coral, and about twice the depth at which *C. affinis* has been obtained in the Azores. The " *Challenger* " locality and depth should therefore be viewed with circumspection; a confusion of the collecting locality is not unlikely. Regardless, the types of *C. affinis* apparently came from the eastern Atlantic; the species is not known from the western Atlantic where several other representatives of the genus *Crypthelia* occur.

No symbionts are known.

Crypthelia medioatlantica new species

Fig. 36 J-M, 38 A-H

Types

Holotype (Fig. 36 J) a delicate subterminal male branch from "*Bartlett*" 1975, stn 14 (ZMUK). Originally 23 mm high and 6 mm wide, comprising 17 cyclosystems, it was subsequently fractured for SEM studies. Paratype (Fig. 36 M) a small branch with 5 cyclosystems from Prince of Monaco stn 242 (MOM).

Type locality: "*Bartlett*" 1975, stn 14, 16.12.1975, 36°50.9'N, 32°57.9'W, 1400-2200 m. Mid-Atlantic Ridge.

Material studied

Azores: Paratype.

Mid-Atlantic Ridge: At 36°50.9'N, Holotype. — "*Nautile*" 1988, cruise HYDROSNAKE dive HS-16, 3 small colonies, dead and manganese coated, largest 34 mm high, with 4, 5, 9 cyclosystems, respectively + 3 isolated cyclosystems (MNHN; USNM 88325).

Description

Only small pieces comprising a total of 42 well preserved cyclosystems (+ one incomplete), from 3 stations in 3 areas are available for the description of this species.

Colonies uniplanar, probably small and delicate. No complete colony available; largest specimen (holotype) with 17 cyclosystems. Subterminal branches only 0.45 mm in diameter. Coenosteum exclusively linear-imbricate in texture (Fig. 38 C-E). Strips 70-85 µm wide and slightly convex, covered with numerous quite narrow platelets 4-14 µm wide. Nematopores not observed.

Cyclosystems circular, 1.2-1.4 mm in diameter (Fig. 36 K-L). Based on 42 cyclosystems (from 3 stations), there is a range of 14-19 dactylopores per cyclosystem, mean 16.12, and mode 15.

Maximum width of upper gastropore chamber about 0.60 mm, which leads to a gastropore ring constriction of about 0.35 mm width (Fig. 38 G). Lower chamber about 0.65 mm wide at greatest diameter and about 0.10 mm deep. Cyclosystem lid digitiform and inclined upwards, covering 0-20 % of the cyclosystem (the lid is sometimes absent). Lid about 0.30 mm wide. Dactylotomes about 0.10 mm wide; pseudosepta of equal width and quite concave (Fig. 36 K-L, 38 A-B, H).

Male ampullae discrete, conspicuous hemispheres (Fig. 38 A-B, F) about 0.6 mm in diameter, 1-4 of which occur around each cyclosystem wall starting in the proximal cyclosystem area adjacent to lid (arrangement C1 of CAIRNS, 1986b). Ampullae covered by a reticulate system of carinae, about 60 µm high, which also extends to upper lid. At apex of each male ampulla is a shallow depression about 0.18 mm in diameter, in the center of which is a small raised papilla about 0.10 mm in diameter. The papilla has an apical pore 40 µm in diameter: the male efferent pore (Fig. 38 A). Female ampullae unknown; however, the 6 other species of *Crypthelia* with C1-type male ampullae all have B-type female ampullae, i.e. ampullae confined to proximal cyclosystem wall, with an efferent pore opening into upper gastropore chamber beneath lid.

Comparisons

Of the 9 Atlantic species of *Crypthelia* (see CAIRNS, 1986a), only one other has C1-type male ampullae: *C. affinis*. Both species are also similar in their average number of dactylopores per cyclosystem, coenosteal strip width, and morphology of pseudosepta and gastropore chamber.

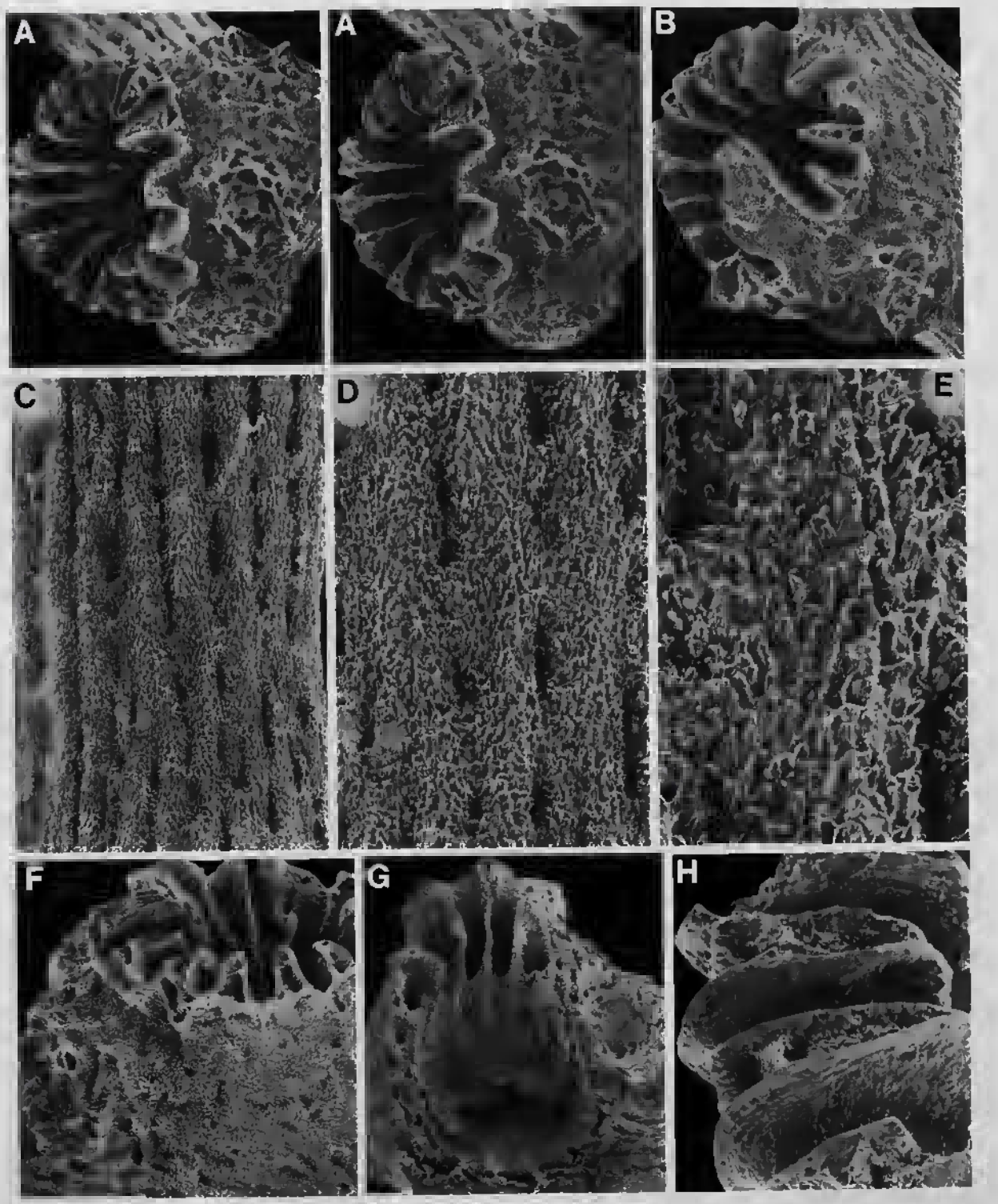

FIG. 38. — *Crypthelia medioatlantica* (A-H, part of holotype, ZMUK): A-B, cyclosystem surrounded by male ampullae, efferent pores visible, lid broken in A (× 34, × 38, respectively, A being a stereo pair); C-E, coenosteal texture (× 73, × 146, × 389, respectively); F, oblique view of cyclosystem and male ampulla (× 49); G, longitudinally fractured cyclosystem revealing gastropore chambers (× 37); H, pseudosepta (× 125).

C. medioatlantica is distinguished most readily by its smaller cyclosystems and branch diameter; its smaller, inclined lids; and its differently shaped platelets and male ampullae.

Remarks

The specific name given to the new species refers to its geographic distribution.

Distribution and ecology

C. medioatlantica is known only from the Azores (861 m) and from the Mid-Atlantic Ridge at 36°50.9'N (1400-2200 m) and at 23°31'N (2644 m).

No symbionts are known.

Crypthelia vascomarquesi new species

Fig. 39 A-J, 40 A-J

Chresonymy:

Crypthelia affinis — Boschma, 1968a: 106 (part: " *Talisman* ").

Crypthelia — Zibrowius & Cairns, 1982: 212 (" unnamed ", part: Hyères Seamount, Azores/part, Madeira).

Crypthelia tenuiseptata — Cairns, 1986a: 117 (part, not Hyères Seamount and Madeira).

Types

All specimens available from the Azores are given type status: " *Talisman* " drag. 128, 3 small subterminal branch fragments comprising 6, 4, and 4 cyclosystems, respectively, the largest one designated holotype (Fig. 39 C-D), the smaller ones paratypes (MNHN). — Prince of Monaco, stn 242, small branch with 7 cyclosystems (paratype, MOM). — " *Jean Charcot* " 1971, cruise Biaçores 1971, stn 232, 3 small dead fragments, with a total of 5 cyclosystems (paratypes, MNHN).

Type locality: " *Talisman* " drag. 128, 16.8.1883, 38°07'N, 27°11'45"W, 983 m. Azores, between São Miguel and Faial.

Material studied

Azores: Holotype and paratypes (see above).

Hyères Seamount: " *Calypso* " 1959, drag. 4, small branch with originally 7 cyclosystems (Fig. 39 A-B) subsequently fractured (5 cyclosystems MNHN; 2 cyclosystems USNM 75622).

Madeira Archipelago: " *Jean Charcot* " 1966, stn 12, small fragment with 1 cyclosystem (MNHN); stn 17, small branch with 4 cyclosystems (MNHN); stn 19, 6 small fragments with a total of 10 cyclosystems (MNHN).

Description

Only 16 small pieces comprising a total of 48 cyclosystems from 7 stations in 3 widely separated areas are available for the description of this species.

Colonies uniplanar, probably small and delicate; known only from subterminal branch fragments with one to a few cyclosystems (Fig. 39 A-J); tallest fragment about 15 mm, bifurcate, and comprising 7 cyclosystems. Subterminal branches very thin (0.5-0.7 mm in diameter), particularly relative to the large cyclosystems they support. Coenosteal strips broad and slightly convex (Fig. 40 B), some up to 0.12 mm wide. Platelets well defined and flat (Fig. 40 C),

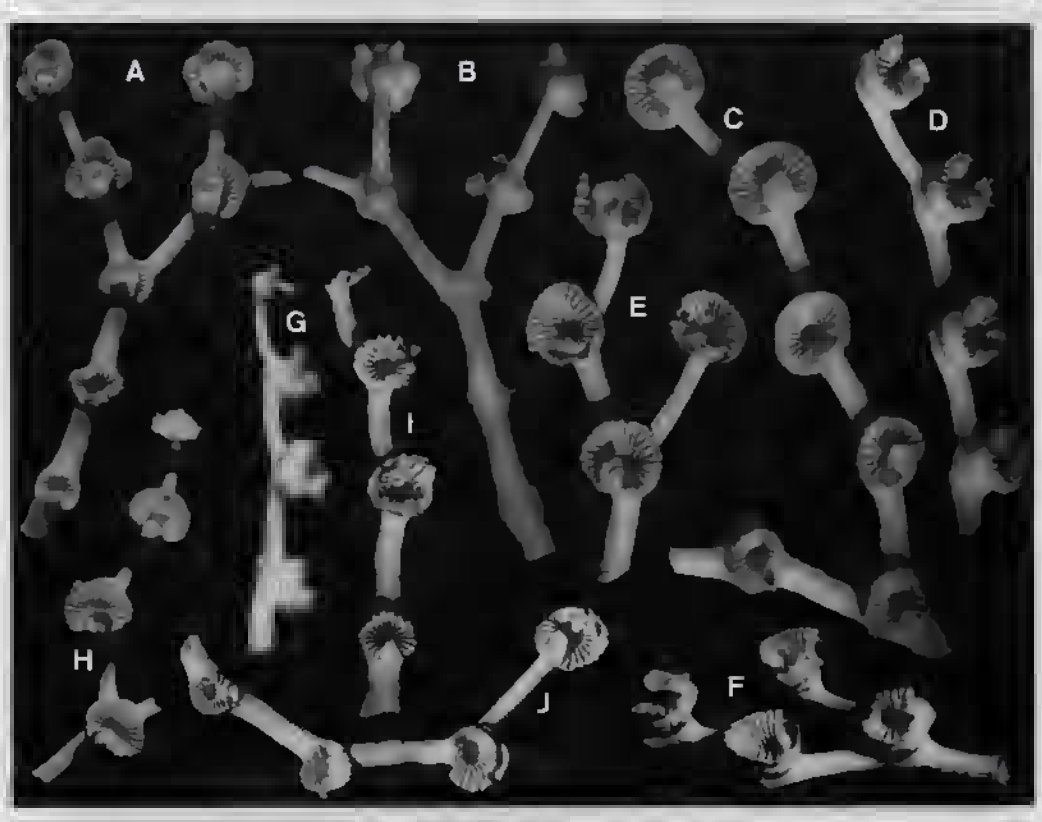

FIG. 39. — *Crypthelia vascomarquesi* (A-B, from " *Calypso* " 1959, drag. 4, MNHN; C-F, from " *Talisman* " drag. 128, MNHN; G-H, from Prince of Monaco stn 242, MOM; I, from " *Jean Charcot* " 1966, stn 19, MNHN; J, from " *Jean Charcot* " 1966, stn 17, MNHN): A-B, anterior and posterior branch faces with bulging female ampullae (both × 3.6); C, holotype (× 4.5); D, part of C, oblique side view (× 4.2); E-F, two views of paratype branch with four cyclosystems (× 4.5, × 4.2, respectively); G-H, two views of paratype branch (× 3.9); I, branch (× 4.2); J, branch (× 4.2).

10-68 µm wide. Large, shallow nematopores, 85-120 µm in diameter occur randomly over coenosteum, ampullae, and lids, and in a more orderly manner on almost every upper outer pseudoseptum (Fig. 40 A, H-I).

Cyclosystems circular to elliptical: circular cyclosystems 2.1-2.6 mm in diameter, elliptical ones about 2.2-2.5 × 1.6-2.0 mm. Cyclosystems very exsert on branch, being elevated by the underlying ring like ampullae (Fig. 39 B, D, F, 40 D, G-H). Based on 47 cyclosystems (out of 48), there is a range of 14-23 dactylopores per cyclosystem, mean 19.38, and mode 21.

Maximum width of upper gastropore chamber about 0.83 mm; gastropore ring constriction about 0.65 mm in diameter. Lower chamber about 1.0 mm wide, with very flat floor. Cyclosystem lid tongue-shaped and horizontal, covering 30-40 % of cyclosystem (Fig. 39 A, C). Lid up to 1.1 mm wide and highly concave. Dactylotomes wide (0.16 mm); pseudosepta correspondingly narrow, about 0.045 mm wide, and only slightly concave. Pseudoseptal edges slightly flared, overhanging underlying ampullar bulge (Fig. 40 H-I).

Male ampullae produce a continuous band encircling cyclosystem and also extend into proximal lid (Fig. 40 A, D-E). Each ampulla appears to be 0.55 mm in diameter, discrete in young cyclosystems but merging into a continuous band in mature cyclosystems. Each ampulla has an efferent pore about 70 µm in diameter, which opens into a contiguous dactylotome within the cyclosystem. Mature cyclosystems have efferent pores opening into almost every dactylotome (Fig. 40 F). Presumed female

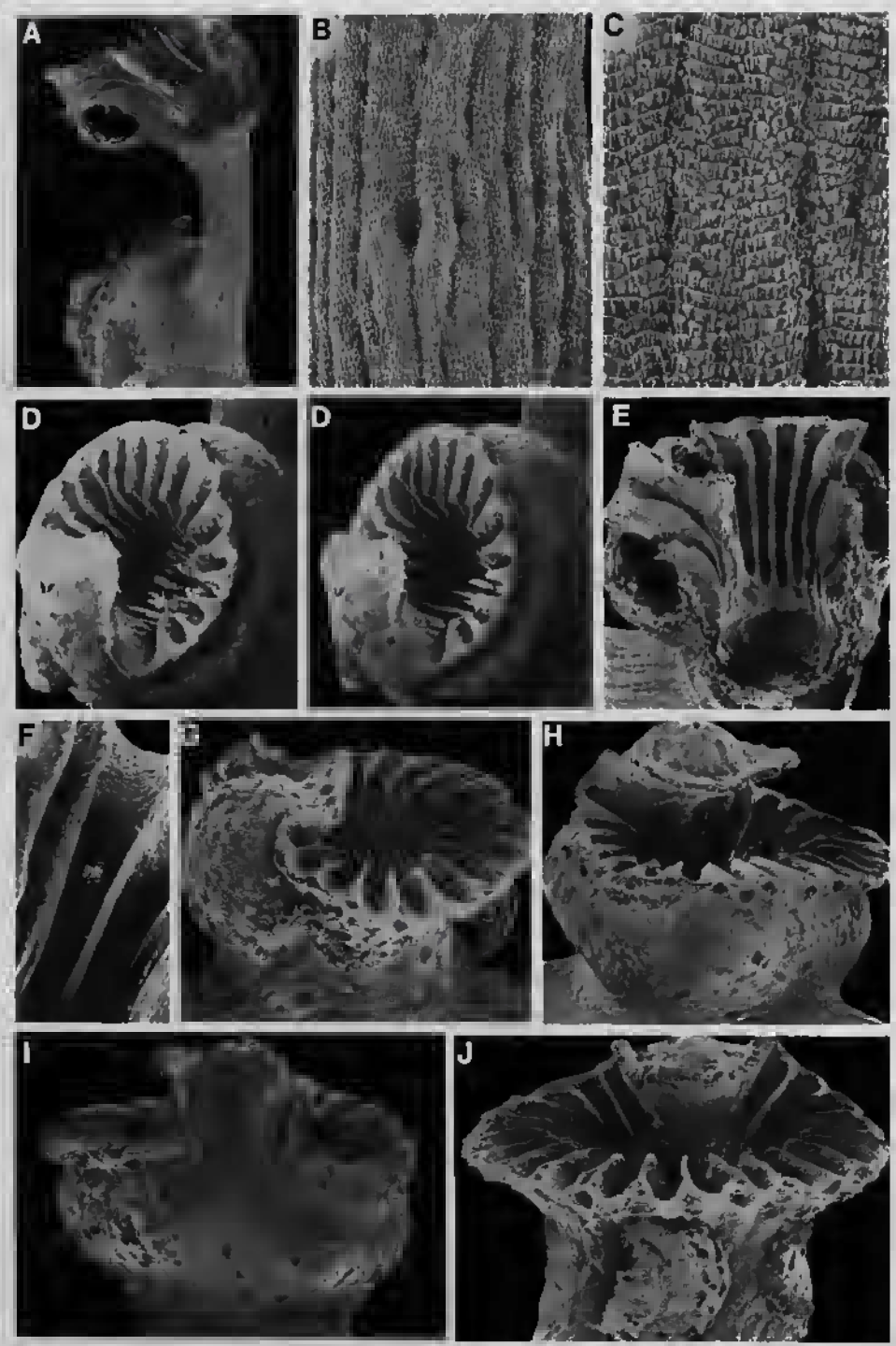

FIG. 40. — *Crypthelia vascomarquesi* (A, D-F, H-I, male paratype from "*Talisman*" drag. 128, MNHN; B-C, G, J, female (?) paratype from Prince of Monaco stn 242, MOM): A, distal branch with fractured cyclosystem encircled by male ampullae, pseudoseptal and coenosteal nematopores present (× 11); B-C, coenosteal texture (× 61, × 140, respectively); D, oblique view of male cyclosystem (× 20, stereo pair); E, longitudinally fractured cyclosystem revealing gastropore chambers and male ampullae (× 19); F, pseudoseptal area within cyclosystem showing male efferent pore in middle dactylotome (× 53); G, J, female (?) cyclosystems and ampullae (× 24, × 26, respectively); H, side view of male cyclosystem illustrated in D (× 19); I, side posterior view of cyclosystem illustrated in fig. D and H (× 19).

ampullae (Fig. 39 B, 40 G, J) more discrete, larger, hemispherical structures up to 1 mm in diameter. One to six female ampullae occur per cyclosystem, concentrating near proximal cyclosystem wall and proximal lid region. Female efferent pores also appear to open to a dactylotome within the cyclosystem; however, more specimens are needed to fully understand the ampullar arrangement of this species.

COMPARISONS

C. vascomarquesi can be distinguished from the other Atlantic congeners by its distinctive ampullar formula (B-C4 + A2) and various other characters (see Table 3). Within the Atlantic, it is most similar to the western Atlantic *C. glossopoma* Cairns, 1986, both species sharing the same ampullar formula (the only 2 of 28 species in the genus) and having similar cyclosystem lids, large nematopores, and very slender, flared pseudosepta. *C. vascomarquesi* is distinguished by its larger cyclosystems, thinner terminal branches, better defined platelet structure, and more prominent ampullae with male efferent pores occurring around the entire circumference of the cyclosystem.

REMARKS

This new species is named in memory of VASCO MONTEIRO MARQUES, Portuguese marine biologist (14.9.1953-19.12.1985).

Having previously resurrected the name *Crypthelia affinis* Moseley, 1879, for another eastern Atlantic stylasterid, BOSCHMA (1968a) incorrectly attributed to that species material from the "*Talisman*" expedition (drag. 128) preserved at the MNHN; in reality, this lot consisted of *C. vascomarquesi* and *C. tenuiseptata*.

Records of *C. vascomarquesi* from Hyères Seamount and Madeira Archipelago had previously been included under *C. tenuiseptata* by CAIRNS (1986a).

DISTRIBUTION AND ECOLOGY

C. vascomarquesi is known from the Azores, the Hyères Seamount, and the Madeira Archipelago, depths respectively 390-983 m, 600 m, and 990-1520 m.

The species is probably more widely distributed in the northeastern Atlantic. A small branch of *Crypthelia*, badly preserved, from near Selvagem Grande ("*Tydeman*" 1983, cruise CANCAP 3 stn 3.099, 585 m; RMNH) possibly belongs to *C. vascomarquesi*. Likewise, the unnamed Stylasteridae from Josephine Seamount (622 m) mentioned and schematically figured by LINDSTRÖM (1877: 15, pl. 2, fig. 25) could also be this species; unfortunately the tiny branch at the SMNH was found entirely decomposed into powder (R. OLERÖD *in litt.*, 1977).

No symbionts are known.

Crypthelia tenuiseptata Cairns, 1986

Fig. 41 A-J, 42 A-I

Synonymy:

Crypthelia tenuiseptata Cairns, 1986a: 115-117 (part, NOT Hyères Seamount, Madeira), fig. 52 A-G, 53 K.

Chresonymy:

[?] *Crypthelia pudica* — FILHOL, 1885: 268, pl. 1.
Crypthelia affinis — BOSCHMA, 1968a: 106 (part: "*Talisman*").
Crypthelia — ZIBROWIUS & CAIRNS, 1982: 212 ("unnamed", part: Azores/part. NOT Hyères Seamount, Madeira).
Crypthelia tenuiseptata — CAIRNS, 1986b: 24-25.

FIG. 41. — *Crypthelia tenuiseptata* (A-C, from " *Talisman* " drag. 128, MNHN; D, from " *Talisman* " drag. 127 ?, MNHN; E-I, from " *Jean Charcot* " 1971, stn 180, MNHN; J, from Prince of Monaco stn 233, MOM): A, female branch (× 1.3); B, peripheral branch (× 4.3); C, male branch (× 2.5); D, massive male colony (× 0.9); E, massive colony (× 0.8); F, detail of E (× 3.1); G, massive colony (× 0.8); H, detail of G (× 3.1); I, peripheral branch (× 4.0); J, detail of massive dead colony (× 0.6).

Types

Crypthelia tenuiseptata: The original description (Cairns, 1986a) is based on 3 small branches (up to 21 mm high and 25 mm wide) from 3 stations in the western Atlantic (" *Blake* " 1878/79, stn 131, Santa Cruz; stn 230, St. Vincent; stn 264, Grenada). These are the designated holotype (stn 264) and paratypes, all deposited at MCZ and USNM (71812 from stn 230).

Type locality: " *Blake* " stn 264, 1.3.1879, 12°03′15″N, 61°48′30″ E, 761 m. Grenada.

Material studied

W Atlantic: holotype and paratypes of *Crypthelia tenuiseptata* (see above).

Azores: " *Talisman* " drag. 127 (?), 3 branches (MNHN); drag. 128, ca. 20 branches + minor fragments (MNHN). — Prince of Monaco, stn 203, 18 dead branches + fragments (MOM); stn 233, big colony (MOM); stn 616, 3 colonies + branches (MOM). — " *Jean Charcot* " 1971, cruise BIAÇORES stn 180, 10 colonies, branches + fragments (most MNHN; USNM 75623); stn 196, ca. 10 dead fragments (MNHN); unknown station, colony (MNHN).

Description

Colonies uniplanar (Fig. 41 A, D, E, G); well-preserved specimens up to 92 mm high and 69 mm wide; a poorly preserved incomplete colony (Prince of Monaco stn 233) was considerably larger: it is still 80 mm high and 72 mm wide, and measures 20 mm across the encrusting base and 12 by 15 mm in the lower part of the massive trunk (Fig. 41 J). Branches with inversed unifaciality of cyclosytem arrangement occasionally occur. Branches often anastomose; subterminal branch diameter about 0.9 mm. Coenosteal strips extremely wide (250-350 μm), and convex to carinate along strip midline (Fig. 41 H). Platelets broad and flat but sometimes irregular in size and shape near cyclosystems (Fig. 42 I). Nematopores extremely large and shallow (Fig. 42 C), about 220 μm in diameter, occurring randomly on branch coenosteum and along lid edge. Invariably there is a tiny coenosteal pit in the center of the nematopore.

Cyclosystems circular to irregular in shape, up to 3.8 mm in diameter. Old cyclosystems flush with coenosteum (Fig. 41 F, H); younger cyclosystems only slightly exsert (Fig. 41 B-C, I). Based on 502 eastern Atlantic (Azores) cyclosystems, there is a range of 15-27 dactylopores per cyclosystem, mean 19.75, and mode 19.

Maximum width of upper gastropore chamber about 1.1 mm; gastropore ring constriction about 0.8 mm in diameter. Lower, compressed chamber about 1.8 mm wide. Cyclosystem lid tongue-shaped and horizontal, covering 60-90 % of cyclosystem. Lid up to 2.3 mm wide and ordinarily quite thin and concave unless inflated with an ampulla. Dactylotomes quite wide (0.20 mm); pseudosepta narrow, about 0.1 mm wide, and not concave.

Female ampullae massive, restricted primarily to cyclosystem lid (Fig. 41 A, F, 42 B, E). Female efferent pores circular and extremely large (0.5 mm in diameter), opening on underside of vertical segment of lid. Male ampullae form a continuous, rather smooth bulge, encircling cyclosystem and occasionally extending into proximal lid. Male efferent pores circular, about 0.13 mm in diameter, opening into adjacent dactylotome within cyclosystem (Fig. 42 C). Some cyclosystems have one male efferent pore per dactylotome (Fig. 42 C). Also shown in Fig. 21 C is the apical efferent pore of the male ampulla in the lid.

Comparisons

C. tenuiseptata is distinguished from the other 8 Atlantic *Crypthelia* by its ampullar formula (A-C4 + A1); other characters are listed in Table 3 and by Cairns (1986a). Only one other species has an A-C4 ampullar formula: *C. gigantea* Fisher, 1938, from the Galápagos. They are also similar

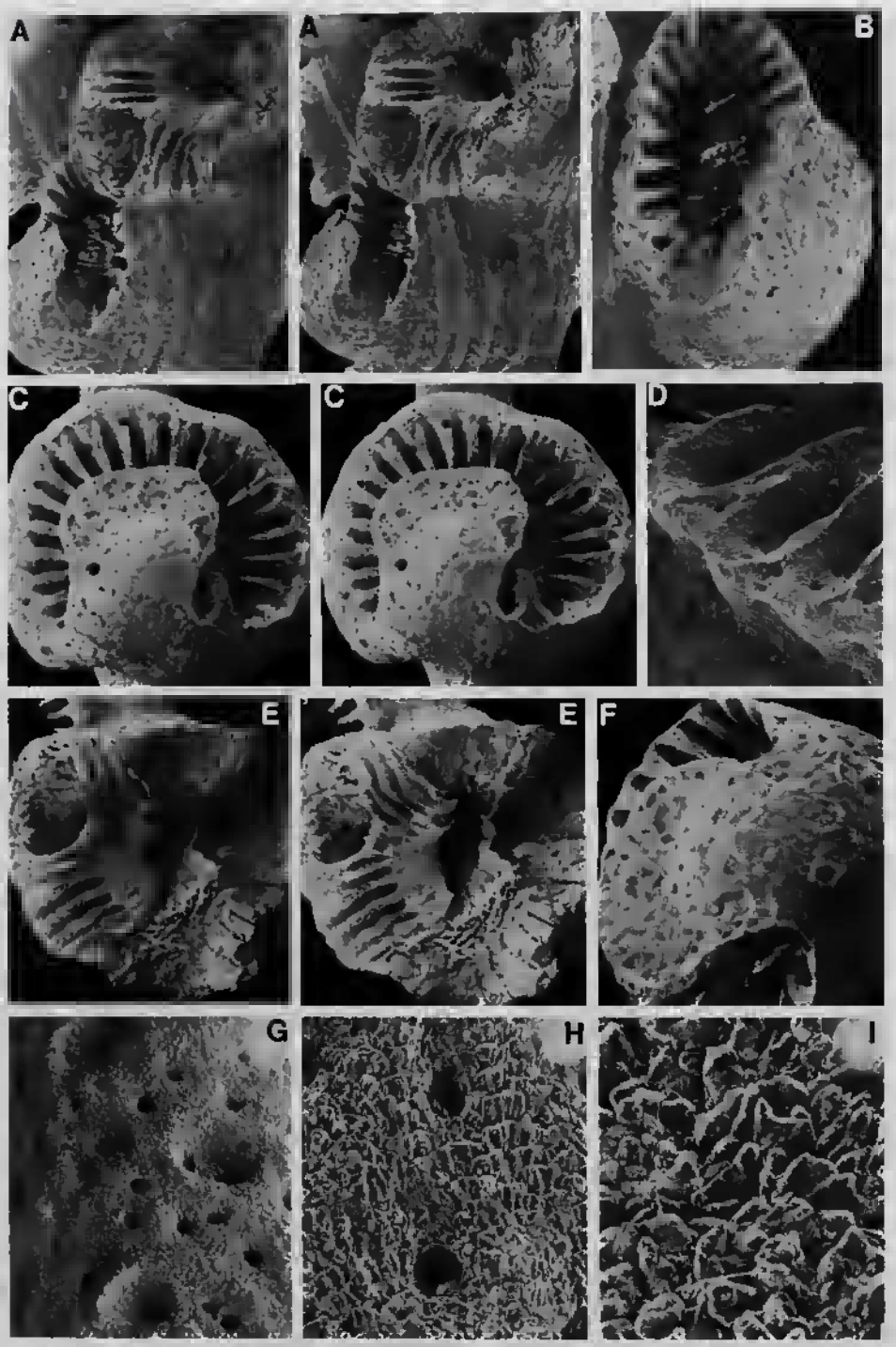

FIG. 42. — *Crypthelia tenuiseptata* (A-B, D-E, female from "*Jean Charcot*" 1971, stn 180, USNM 75623; C, F-I, male from "*Talisman*" drag. 127 ?, MNHN): A, branch segment illustrating cyclosystems, cyclosystem lid, gastropore chambers, and gross coenosteal texture (× 8.4, stereo pair); B, oblique view of female cyclosystems with ampullar bulge in lid (× 13); C, intact male cyclosystems showing numerous efferent pores opening into upper dactylotomes (× 11); D, pseudosepta (× 47); E, longitudinal fracture of female cyclosystem illustrating gastropore chambers and female ampulla (× 10, stereo pair); F, side posterior view of male cyclosystem of C (× 16); G, branch coenosteum with numerous coenosteal pores and three shallow nematopores (× 44); H-I, coenosteal texture (× 124, × 397, respectively).

in having massive coralla with very large cyclosystems, wide coenosteal strips, and relatively thin pseudosepta. *C. tenuiseptata* is distinguished from *C. gigantea* by its very large nematopores (*C. gigantea* has none), even broader coenosteal strips, and a lower average number of dactylopores per cyclosystem (see CAIRNS, 1986b).

REMARKS

C. tenuiseptata was described by CAIRNS (1986a) from 3 small branches from the western Atlantic, where larger colonies are still unknown. Previously, it had been mentioned by ZIBROWIUS & CAIRNS (1982) as an unnamed amphiatlantic species of *Crypthelia* from 3 areas in the eastern Atlantic (Azores, Hyères Seamount, Madeira). Although the species is amphiatlantic, the indicated distribution was partly incorrect because it included a second form now distinguished as *C. vascomarquesi*. In fact, in the eastern Atlantic the occurrence of *C. tenuiseptata* is confirmed only for the Azores, whereas *C. vascomarquesi* also occurs in the other areas (Hyères Seamount, Madeira Archipelago).

C. tenuiseptata, which had much earlier been collected in the Azores, had not been recognized as a distinct species by previous authors. A colony of unknown origin (" *Talisman* ", depth 800 m) figured by FILHOL (1885) and misidentified as *C. pudica*, may well belong to *C. tenuiseptata*, which indeed is represented in the " *Talisman* " collection by several large specimens.

Having previously resurrected the name *Crypthelia affinis* for another eastern Atlantic stylasterid, BOSCHMA (1968a) incorrectly attributed to that species material from the " *Talisman* " expedition (drag. 128) preserved at the MNHN; in reality, this lot consisted of *C. tenuiseptata* and *C. vascomarquesi*.

DISTRIBUTION AND ECOLOGY

C. tenuiseptata is noteworthy as one of the rare amphiatlantic stylasterids. It is known from the Virgin Islands, Lesser Antilles (761-1080 m), and from the Azores (983-1557 m). In the Azores live specimens were obtained as deep as 1257 m.

No symbionts are known.

Note added in press

We refer to a large collection of stylasterids (currently being studied by H.Z.) obtained around the Faroe Islands by the BIOFAR project (1987-1990), in fact the richest collection ever obtained in high latitudes of the North Atlantic. BIOFAR found all four species previously known from high latitudes but not all material is yet sorted: *Pliobothrus symmetricus* (8 stations), *Stylaster norvegicus* (45 stations), *Stylaster gemmascens* (21 stations), *Stylaster erubescens* (25 stations).

In addition, some samples of stylasterids from poorly collected areas (West Africa and Canary Islands) were discovered in the collections of the ZMUK and the Institute of Oceanographic Sciences (the latter samples now transferred to the BMNH).

Stenohelia maderensis

Sahara: " Discovery " stn 7975, 19.7.1972, 26°23.64′ N, 14°51.10′ W, 785-834 m, 5 dead fragments, the largest 11 mm high (BMNH); stn 7984, 20.7.1972, 25°26.00′ N, 16°10.25′ W, 811-890 m, 24 specimens (BMNH), ranging from a small incomplete colony with base (distal cyclosystems broken off), 13 mm high and 10 mm wide through branchlets to fragments with only very few or even one cyclosystem; few specimens alive, but some of the dead ones fresh-looking.

These records from the upper slope off West Africa fill in a wide gap of latitudinal distribution between the Cape Verde Islands and Madeira.

Crypthelia vascomarquesi

Canary Islands: " Dana " stn 4011, 25.3.1930 (coll. Th. MORTENSEN), 9 nautical miles SE of Las Palmas, Gran Canaria, 670-1100 m; small dead colony (ZMUK) with base, 11 mm high, with 5 cyclosystems, the basalmost being filled in by sclerenchyme; distal cyclosystems broken off (missing); two cyclosystems have 17 dactylopores, the other damaged ones also more than, respectively, 14 and 15.

This record from the " Dana " circumnavigation is the first confirmed record of a stylasterid from the Canary Islands. It extends the range of the species farther south (ca. 3 degrees of latitude).

LIST OF DEEP-WATER STATIONS FROM OCEANOGRAPHIC CRUISES

This is an inventory of stations from oceanographic cruises in the northeastern Atlantic Ocean, in the straits of Gibraltar, and in the Mediterranean from which stylasterid corals and/or their *Pedicularia* symbionts (or occasionally only the traces of *Pedicularia*), were available for the present study, or are quoted here from the previous literature.

Examples: " *Lepidopora eburnea* + trace of *Pedicularia* " means that only the trace, not the symbiont itself, was found on the stylasterid; " *Errina atlantica* + *Pedicularia* " means that the symbiont was found on its host; " *Errina dabneyi* + trace of *Pedicularia*, *Pedicularia* " means that only the trace was found on the stylasterid, but that *Pedicularia* from this station was no longer attached to a stylasterid host.

The vessels are listed in alphabetical order; under each vessel the cruises and stations are chronologically arranged, following the current station numbers, either continuous for the vessel, or distinct for each cruise. Prince of Monaco stands for all the cruises carried out by Albert I, Prince of Monaco, on several vessels. Whenever possible, the (main) depository of material is indicated for each vessel or cruise.

The present list summarizes the greater and more diversified part of the stylasterid records from the investigated area. Additional records not from these cruises are found under " material studied " of most species sections. These additional records comprise samples of imprecise origin in old museum collections, collections by fishermen, etc.

" *Al Mounir* " 1969 (collector J. STIRN; material in MNHN, USNM)
B6-D6: 2.7.1969, 35°55'00"N, 5°34'55"W, 350m, Straits of Gibraltar: *Errina aspera*
B8-D2: 5.7.1969, 35°54'15"N, 5°46'00"W, 365-390m, Straits of Gibraltar: *Errina aspera*
B10-D3: 21.7.1969, 33°43'30"N, 6°21'00"W, 200m, NW Morocco: *Errina aspera* + *Pedicularia*

" *Anton Dohrn* " (collector G. BEHRMANN; material in IMFB)
stat. ?: 10.3.1972, 68°30'N, 12°19'E, 300m, Norway: *Stylaster norvegicus*
stat. ?: 18.11.1973, 63°00'N, 6°30'W, 1040m, Faroes: *Stylaster norvegicus*
stat. ?: 19.11.1973, 62°07'N, 6°27'W, 75m, Faroes: *Stylaster norvegicus*

" *Bannock* " 1972, cruise IOTI 72: Straits of Messina (collector P. COLANTONI)
23: 7.1972, 38°14.56'N, 15°37.7'E, 95m: *Errina aspera* + *Pedicularia*
34: 7.1972, 38°12.7'N, 15°36.4'E, 220m: *Pedicularia* (*fide* SELLI *et al.*, 1980; stylasterid host not recorded, but undoubtedly *Errina aspera*)
47: 7.1972, 38°17.2'N, 15°44.0'E, 329m: *Pedicularia* (same remark as for stn. 34)

" *Bartlett* " 1975 (collector J. KNUDSEN; material in USNM)
2: 30.1.1975, 37°13.8'N, 28°44.5'W, 480m, Azores: *Lepidopora eburnea* + trace of *Pedicularia*
4: 3.2.1975, 38°09.8'N, 28°53.4'W, 750-800m, Azores: *Lepidopora eburnea* + trace of *Pedicularia*
14: 16.2.1975, 36°50.9'N, 32°57.9'W, 1400-2200m, Mid-Atlantic Ridge: *Errina dabneyi*, *Crypthelia medioatlantica*

" *Bartlett* " 1975 (collector BYERLY; material in USNM)
52C-5: 23.9.1975, 61°59.7'N, 26°35'-36'W, 585m, SW Iceland, Reykjanes Ridge: *Stylaster erubescens groenlandicus*

" *Calypso* " 1958 (material in MNHN)
SME-1277: 28.8.1958, approx. 36°30'N/11°30'W, 510m, Gorringe Seamount: *Lepidopora* sp. A
SME-1282: 30.8.1958, 35°54'N, 6°00'W, 110m, NW Morocco, Spartel Bank: *Errina aspera* + *Pedicularia*

"*Calypso*" 1959 (collector G. BELLAN; material in MNHN, USNM)
drag. 4: 13.8.1959, 31°26.6'N, 28°55.4'W, 600m, Hyères Seamount: *Pliobothrus gracilis, Crypthelia vascomarquesi*
drag. 6: 13.8.1959, 31°27.7'N, 28°55.6'W, 620-700m, Hyères Seamount: *Pliobothrus gracilis*

"Calypso" 1959: Cape Verde Islands (material in MNHN)
16: 17.11.1959, W São Tiago, NW Ponta Geneanes, 235-400m: *Stenohelia maderensis*
91: 27.11.1959, 15°34.5'N, 23°11.5'W, 185m, between Maio and Boavista: *Stenohelia maderensis*

"*Chain*" 1959, cruise 7 (material in USNM)
PD-24: 31.7.1959, 30°00'N, 28°25'N, 295m, Great Meteor Seamount: *Stylaster erubescens meteorensis*

"*Challenger*" 1873 (material in BMNH)
3: 8.2.1873, 25°45'N, 20°12'W, 2795m, far SW Canary Islands: *Crypthelia affinis*
85: 19.7.1873, 28°42'N, 18°06'W, 2100m, Canary Islands, W Palma: *Lepidopora* sp. B

"*Challenger II*" 1977 (collector J.D. GAGE; material in BMNH)
6A-134: 9.4.1977, 54°05'N, 12°06'W, 800m, W Ireland: *Pliobothrus symmetricus*

"*Challenger II*" 1981 (collector T.P. SCOFFIN; material in BMNH)
30: 7.1981, 53°16.76'N, 14°35.47'W, 520m, Porcupine Bank: *Pliobothrus symmetricus, Stylaster* sp.

"*Cryos*" 1984, cruise BALGIM (collector H. ZIBROWIUS; material in MNHN)
DR-37: 1.6.1984, 36°17.8'N, 7°15.4'W, 860-868m, western approaches Straits of Gibraltar: *Pedicularia* (stylasterid host unknown, most likely *Errina aspera*)
DR-40: 2.6.1984, 35°49.9'N, 6°08.6'W, 362m, Straits of Gibraltar, W sill: *Errina aspera, Pedicularia*
DR-49: 3.6.1984, 35°53.0'N, 6°32.8'W, 524-578m, western approaches Straits of Gibraltar: *Errina aspera*
DW-50: 3.6.1984, 35°52.7'N, 6°31.9'W, 518-524m, western approches Straits of Gilbraltar: *Pedicularia* (stylasterid host unknown, most likely *Errina aspera*)
CP-95: 8.6.1984, 34°24.0'N, 7°39.3'W, 1378m, NW Morocco: *Lepidopora* sp. A, *Stylaster maroccanus*
DR-115: 11.6.1984, 35°47.5'N, 6°04.2'W, 332m, Straits of Gibraltar, W sill: *Errina aspera*
DR-116: 11.6.1984, 35°48.6'N, 6°04.2'W, 322-365m, Straits of Gibraltar, W sill: *Errina aspera*
DR-153: 17.6.1984, 35°55.8'S, 5°35.3'W, 568-604m, Straits of Gibraltar, E sill: *Pedicularia* (stylasterid host unknown, most likely *Errina aspera*)

"*Dana*" 1938 (material in ZMUK)
5835: 14.5.1938, 62°35'N, 7°52'W, 400m, W Faroes: *Stylaster gemmascens*
6001: 24.7.1938, 63°33'N, 11°25'W, 322m, SE Iceland: *Stylaster erubescens* (*britannicus*?)
6005: 25.7.1938, 62°19'N, 8°51'W, 475-504m, W Faroes: *Stylaster gemmascens*
6009: 26.7.1938, 61°14'N, 7°04'W, 220m, S Faroes: *Stylaster gemmascens*

"*Gazelle*" 1874: Madeira Archipelago (material in ZMB)
2: 16.7.1874, S Madeira, 2 miles off shore, 110-128m: *Stenohelia maderensis*

"*Ingolf*" 1895-1896 (material in ZMUK)
1: 11.5.1895, 62°30'N, 8°21'W, 249m, W Faroes: *Stylaster gemmascens*
2: 12.5.1895, 63°04'N, 9°22'W, 493m, NW Faroes: *Stylaster gemmascens*
7: 17.5.1895, 63°13'N, 15°41'W, 1130m, SE Iceand: *Stylaster erubescens groenlandicus*
15: 4.6.1895, 66°18'N, 25°59'W, 621m, NW Iceand: *Stylaster norvegicus, S. gemmascens* (both *fide* BROCH, 1914a), *S. erubescens groenlandicus*
16: 5.6.1895, 65°43'N, 26°58'W, 471m, NW Iceland: *Stylaster gemmascens, S. erubescens groenlandicus*
17: 6.6.1895, 62°49'N, 26°55'W, 1403m, SW Iceland: *Stylaster norvegicus, S. erubescens* (*groenlandicus*?) (both *fide* BROCH, 1914a)
52: 15.5.1896, 63°57'N, 13°32'W, 791m, SE Iceland: *Stylaster norvegicus, S. erubescens groenlandicus*
55: 19.5.1896, 63°33'N, 15°02'W, 595m, SE Iceland: *Pliobothrus symmetricus, Stylaster norvegicus* (both *fide* BROCH, 1914a)
57: 20.5.1896, 63°37'N, 13°02'W, 659m, SE Iceland: *Pliobothrus symmetricus* (*fide* BROCH, 1914a)
94: 26.6.1896, 64°56'N, 36°19'W, 384m, E Greenland, off Angmagssalik: *Stylaster gemmascens, S. erubescens* (*groenlandicus*?) (*fide* BROCH, 1914)
144: 11.8.1896, 62°49'N, 7°12'W, 520m, N Faroes: *Stylaster erubescens britannicus*

"*Jean Charcot*" 1966, cruise ZARCO: Madeira Archipelago (material in MNHN)
12: 13.7.1966, 32°36.2'N, 17°07.7'W, 1520m, S Madeira: *Crypthelia vascomarquesi*

17: 15.7.1966, 32°58.5'N, 16°26.5'W, 1630-1690m, SW Porto Santo: *Crypthelia vascomarquesi*
19: 15.7.1966, 33°00.2'N, 16°20.0'W, 990m, SW Porto Santo: *Crypthelia vascomarquesi*
21: 15.7.1966, 33°01.2'N, 16°24.9'W, 220-290m, SW Porto Santo: *Stenohelia maderensis*
29: 16.7.1966, 33°01.4'N, 16°15.5'W, 300-340m, SW Porto Santo: *Stenohelia maderensis* + trace of *Pedicularia*
49: 18.7.1966, 32°27.3'N, 16°32.0'W, 450-490m, SW Deserta: *Pliobothrus symmetricus*?, *Stenohelia maderensis*

"*Jean Charcot*" 1971, cruise BIAÇORES: Azores (collector H. ZIBROWIUS; material in MNHN, USNM)
25: 9.10.1971, 38°21'N, 28°49.5'W, 800-1020m: *Crypthelia affinis*
34: 10.10.1971, 38°09.5'N, 29°15.0'W, 650-670m: *Pliobothrus symmetricus*
49: 12.10.1971, 37°56'N, 29°12'W, 215-225m: *Errina dabneyi* + trace of *Pedicularia, Pedicularia*
74: 15.10.1971, 38°28.5'N, 27°54.5'W, 1235-1310m: *Crypthelia affinis*
102: 19.10.1971, 39°30'N, 31°04.5'W, 712-750m: *Crypthelia affinis*
112: 20.10.1971, 39°34'N, 31°19.5'W, 806-825m: *Crypthelia affinis*
135: 25.10.1971, 39°24.5'N, 31°05.5'W, 760-860m: *Crypthelia affinis*
159: 31.10.1971, 37°26'N, 25°51'W, 525-600m: *Lepidopora eburnea*
161: 31.10.1971, 37°39.5'N, 25°50.5'W, 590m: *Lepidopora eburnea* + trace of *Pedicularia, Pliobothrus symmetricus*
180: 3.11.1971, 37°57.5'N, 25°33'W, 1069-1235m: *Crypthelia affinis, C. tenuiseptata*
196: 5.11.1971, 37°50'N, 24°55.5'W, 1146-1191m: *Crypthelia tenuiseptata*
197: 5.11.1971, 37°49.5'N, 25°01.5'W, 815m: *Pliobothrus symmetricus, Errina atlantica* + trace of *Pedicularia, Pedicularia*
212: 7.11.1971, 37°18'N, 24°45.5'W, 610m: *Errina atlantica*
213: 7.11.1971, 37°21.5'N, 24°32.5'W, 895m: *Lepidopora eburnea* + trace of *Pedicularia, Pliobothrus symmetricus*
218: 8.11.1971, 36°54'N, 25°08'W, 772-800m: *Pliobothrus symmetricus*
229: 10.11.1971, 37°01.5'N, 25°14'W, 600m: *Lepidopora eburnea* + trace of *Pedicularia, Pliobothrus symmetricus*
230: 10.11.1971, 36°54'N, 25°09.5'W, 665-712m: *Errina atlantica*
231: 10.11.1971, 36°55'N, 25°10'W, 380-440m: *Pliobothrus symmetricus*
232: 10.11.1971, 36°55'N, 25°11'W, 390-620m: *Pliobothrus symmetricus, Crypthelia vascomarquesi*
238: 11.11.1971, 37°25'N, 25°45'W, 506m: *Pliobothrus symmetricus*
240: 12.11.1971, 37°35'N, 25°32.5'W, 810-825m: *Pliobothrus* sp., *Errina atlantica* + *Pedicularia*
stat. ?: 1971, Azores: *Lepidopora eburnea* + trace of *Pedicularia, Stenohelia* sp. A

"*John Murray*" 1972 (collector E.J.W. JONES; material in BMNH)
site 4/dredge: 3./4.1972, 57°24'N, 10°45'W, 1500m, Anton Dohrn Seamount: *Stylaster erubescens britannicus*

"*Josephine*" 1869: Josephine Seamount (material in SMNH)
stat. ?: 1869, approx. 36°46'N/14°07'W, 622m: *Crypthelia* sp. (*fide* LINDSTRÖM, 1877)

"*Meteor*" 1970, cruise M19: Great Meteor Seamount (material in ZSM)
129/DD-94: 17.2.1970, 29°59'N, 28°33'W, 293-296m: *Stylaster erubescens meteorensis*
129/DD-95: 17.2.1970, 30°00'N, 28°31.5'W, 293m: *Stylaster erubescens meteorensis*
131/DD-98: 17.2.1970, 30°06'N, 28°33'W, 303m: *Stylaster erubescens meteorensis*

"*Michael Sars*" 1902: Faroes (material in VSM)
43: 4.7.1902, 62°31'N, 5°14'W, 320m, NE Faroes: *Stylaster gemmascens*
stn ?: 25.2.1904, 16 miles E Faroes, 376m: *Pliobothrus symmetricus*

submersible "*Nautile*" 1988, cruise HYDROSNAKE (material in MNHN, USNM)
HS-16: 5.7.1988, 23°31'N, 45°10'W, 2644m, Mid-Atlantic Ridge: *Crypthelia medioatlantica*

"*Noroit*" 1987, cruise SEAMOUNT (collector H. ZIBROWIUS; material in MNHN)
DW-8: 22.9.1987, 36°28.5'N, 11°37.1'W, 470-485m, Gorringe Seamount: *Lepidopora* sp. A
DE-10: 23.9.1987, 36°27.4'N, 11°35.0'W, 500-545m, Gorringe Seamount: *Lepidopora* sp. A, *Pedicularia*
CP-11: 23.9.1987, 36°26.4'N, 11°40.2'W, 805-830m, Gorringe Seamount: *Lepidopora* sp. A
CP-12: 23.9.1987, 36°24.2'N, 11°43.2'W, 1005-1040m, Gorringe Seamount: *Lepidopora* sp. A
DE-13: 23.9.1987, 36°23.0'N, 11°42.5'W, 1110-1180m, Gorringe Seamount: *Lepidopora* sp. A, *Errina atlantica*?
DW-21: 24.9.1987, 36°34.9'N, 11°28.4'W, 460-480m, Gorringe Seamount: *Lepidopora* sp. A, *Errina atlantica*?
CP-30: 26.9.1987, 36°44.3'N, 11°23.0'W, 1940-2075m, Gorringe Seamount: *Lepidopora* sp. A,

DW-56: 7.10.1987, 36°42.3'N, 14°21.6'W, 360-425m, Josephine Seamount: *Pliobothrus symmetricus*
DW-58: 7.10.1987, 36°45.9'N, 14°20.4'W, 340-380m, Josephine Seamount: *Pliobothrus symmetricus*
DW-78: 10.10.1987, 33°48.7'N, 14°22.6'W, 235m, Seine Seamount: *Lepidopora* sp. A
DE-98: 12.10.1987, 35°03.2'N, 12°55.4'W, 300-325m, Ampère Seamount: *Pedicularia* (stylasterid host unknown)
DW-108: 19.10.1987, 42°50.9'N, 11°53.1'W, 1100-1125m, Galicia Seamount: *Lepidopora* sp. A, *Stenohelia maderensis*
DW-111: 19.10.1987, 42°39.9'N, 11°35.8'W, 675-685m, Galicia Seamount: *Lepidopora* sp. A, *Pliobothrus symmetricus*?, *Pedicularia*
DW-116: 20.10.1987, 42°52.44'N, 11°50.6'W, 985-1000m, Galicia Seamount: *Lepidopora* sp. A, *Stenohelia maderensis*, *Pedicularia*

submersible "*Pisces III*" 1973 (collector J.B. WILSON; material in BMNH)
P73-5: 24.6.1973, 57°54.9'N, 13°52.3'W, 160-190m, Rockall Bank: *Stylaster gemmascens*

"*Porcupine*" 1869: between Faroes and Hebrides (material in BMNH)
54: 1869, 59°56'N, 6°27'W, 665m: *Stylaster norvegicus, S. gemmascens, S. erubescens britannicus, Stenohelia maderensis*

"*Poseidon*" 1990, cruise 175/1: Denmark Strait (collector A. FREIWALD; material in SMF, USNM)
12/1: 18.10.1990, 65°26.76'N, 30°50.31'W, 477m: *Stylaster norvegicus, S. gemmascens, S. erubescens groenlandicus*
14/1: 18.10.1990, 65°29.70'N, 30°01.92'W, 433m: *Stylaster norvegicus, S. gemmascens, S. erubescens groenlandicus*

Prince of Monaco 1888-1905 (material in MOM)
203: 30.7.1888, 39°27'05"N, 30°55'05"W, 1557m, Azores: *Crypthelia affinis, C. tenuiseptata*
229: 16.8.1888, 38°22'N, 28°14'24"W, 736m, Azores: *Lepidopora eburnea, Pedicularia*
233: 18.8.1888, 38°33'21"N, 28°08'39"W, 1300m, Azores: *Crypthelia affinis, C. tenuiseptata, Pedicularia*
242: 22.8.1888, 38°48'30"N, 27°58'45"W, 861m, Azores: *Crypthelia medioatlantica, C. vascomarquesi*
247: 30.8.1888, 38°24'N, 28°01'25"W, 318m, Azores: *Errina dabneyi* + trace of *Pedicularia, Pedicularia*
553: 3.7.1895, 37°42'40"N, 25°05'15"W, 1385m, Azores: *Pedicularia* (stylasterid host unknown)
568: 11.7.1895, 37°54'N, 25°35'25"W, 550m, Azores: *Pliobothrus symmetricus* (*fide* CALVET, 1911)
584: 16.7.1895, 38°31'N, 26°49'15"W, 845m, Azores: *Pliobothrus symmetricus* (*fide* CALVET, 1911), *Pedicularia*
597: 23.7.1895, 38°27'N, 28°03'25"W, 523m, Azores: *Lepidopora eburnea, Pliobothrus symmetricus* (*fide* CALVET, 1911), *Pedicularia*
616: 1.8.1895, 38°47'40"N, 28°17'05"W, 1022m, Azores: *Pliobothrus symmetricus* (*fide* CALVET, 1911), *Crypthelia tenuiseptata*
618: 1.8.1895, 38°52'45"N, 28°06'00"W, 1142m, Azores: *Pliobothrus symmetricus* (*fide* CALVET,1911)
683: 7.7.1896, 38°20'N, 28°04'45"W, 1550m, Azores: *Pliobothrus symmetricus* (*fide* CALVET, 1911)
712: 24.7.1896, 39°39'40"N, 31°00'55"W, 1424m, Azores: *Pliobothrus symmetricus* (*fide* CALVET, 1911)
719: 27.7.1896, 39°11'N, 30°24'15"W, 1600m, Azores: *Pliobothrus symmetricus* (*fide* CALVET, 1911)
838: 22.7.1897, 37°55'N, 25°22'45"W, 880m, Azores: *Pliobothrus symmetricus* (*fide* CALVET, 1911)
866: 2.8.1897, 38°52'50"N, 27°23'05"W, 599m, Azores: *Pliobothrus symmetricus* (*fide* CALVET, 1911)
869: 3.8.1897, 39°03'N, 27°42'45"W, 1240m, Azores: *Pliobothrus symmetricus* (*fide* CALVET, 1911)
1349: 19.8.1902, 38°35'30"N, 28°05'45"W, 1250m, Azores: *Pedicularia* (stylasterid host unknown)
1713: 1.8.1904, 28°04'N, 16°49'30"W, 1320-1530m, Canary Islands, between Tenerife and Gomera: *Pedicularia* (stylasterid host unknown)
2210: 1.9.1905, 39°25'N, 31°22'30"W, 1229m, Azores: *Pedicularia* (stylasterid host unknown)

"*Talisman*" 1883 (material in MNHN, BMNH)
drag. 96: 15.7.1883, 19°19'N, 18°01'45"W, 2320-2330m, Mauritania: *Lepidopora* sp. A
drag. 103: 23.7.1883, Cape Verde Islands, S São Tiago, off Praia, 150-275m: *Stenohelia maderensis*
drag. 114: 30.7.1883, 16°51'N, 25°09'45"W, 598-633m, Cape Verde Islands: *Errina aspera* + trace of *Pedicularia*
drag. 123: 13.8.1883, 38°23'N, 28°49'45"W, 560m, Azores: *Lepidopora eburnea* + trace of *Pedicularia, Pliobothrus symmetricus, Errina dabneyi*
drag. 127: 15.8.1883, 38°38'N, 28°20'45"W, 1257m, Azores: *Crypthelia tenuiseptata*
drag. 128: 16.8.1883, 38°07'N, 27°11'45"W, 983m, Azores: *Lepidopora eburnea, Errina atlantica* + trace of *Pedicularia, Crypthelia vascomarquesi, C. tenuiseptata, Pedicularia*
drag.129: 16.8.1883, 38°00'N, 27°02'45"W, 2155-2220m, Azores: *Pedicularia* (confused, from drag. 128?; stylasterid host unknown)

" *Thalassa* " 1967-1973 (1972-1973 collector H. ZIBROWIUS; material in MNHN, USNM)
T-503: 10.8.1967, 44°00.7'N, 7°06.9'W, 490m, SW Bay of Biscay: *Stenohelia maderensis*
U-807: 18.8.1968, 44°11'N, 8°40,2'W, 450-500m, NW Spain: *Stylaster ibericus*
X-340: 16.10.1971, 44°07'N, 4°29.8'W, 860-910m, S Bay of Biscay, Le Danois Bank: *Stenohelia maderensis*
X-341: 16.10.1971, 44°07.3'N, 4°30.7'W, 800-840m, S Bay of Biscay, Le Danois Bank: *Stenohelia maderensis*
X-342: 16.10.1971, 44°07.5'N, 4°36.2'W, 700m, S Bay of Biscay, Le Danois Bank: *Stenohelia maderensis*
X-347: 16.10.1971, 44°07.3'N, 4°44'W, 640-910m, S Bay of Biscay, Le Danois Bank: *Stenohelia maderensis*
X-352: 17.10.1971, 44°06.5'N, 4°45.2'W, 545-580m, S Bay of Biscay, Le Danois Bank: *Stenohelia maderensis*
X-353: 17.10.1971, 44°06.8'N, 4°45.1'W, 635-655m, S Bay of Biscay, Le Danois Bank: *Stenohelia maderensis, Pedicularia*
X-362: 17.10.1971, 44°06.5'N, 4°50.9'W, 585-600m, S Bay of Biscay, Le Danois Bank: *Stenohelia maderensis*
X-363: 17.10.1971, 44°06'N, 4°53.2'W, 545-630m, S Bay of Biscay, Le Danois Bank: *Stenohelia maderensis*
Y-428: 4.9.1972, 44°11.8'N, 8°40.6'W, 500m, NW Spain: *Stylaster ibericus*
Y-430: 4.9.1972, 44°11.6'N, 8°40.6'W, 500m, NW Spain: *Stylaster ibericus* + *Pedicularia*
Y-431: 4.9.1972, 44°12.6'N, 8°40.7'W, 540m, NW Spain: *Stylaster ibericus*
Y-432: 4.9.1972, 44°12'N, 8°40.6'W, 515m, NW Spain: *Stylaster ibericus* + *Pedicularia*
Y-434: 4.9.1972, 44°12'N, 8°40.8'W, 620m, NW Spain: *Stylaster ibericus*
Y-436: 4.9.1972, 44°12.6'N, 8°40.8'W, 620m, NW Spain: base of tiny stylasterid, unidentified
Y-438: 4.9.1972, 44°12'N, 8°40.3'W, 545m, NW Spain: *Stylaster ibericus*
Y-440: 4.9.1972, 44°12.2'N, 8°40.2'W, 490m, NW Spain: *Stylaster ibericus* + trace of *Pedicularia*
Z-407: 23.10.1973, 47°43.6'N, 8°07.5'W, 1085-1115m, Celtic Sea: *Pliobothrus symmetricus*
Z-415: 24.10.1973, 48°07.2'N, 8°26.2'W, 380m, Celtic Sea: *Pliobothrus symmetricus* + trace of *Pedicularia*
Z-430: 25.10.1973, 48°37.0'N, 9°52.2'W, 1080m, Celtic Sea: *Stylaster erubescens britannicus* + trace of *Pedicularia*
Z-431: 25.10.1973, 48°38.2'N, 9°47.3'W, 800m, Celtic Sea: *Pliobothrus symmetricus*
Z-435: 26.10.1973, 48°39.7'N, 9°53.2'W, 1050m, Celtic Sea: *Pliobothrus symmetricus* + trace of *Pedicularia, Stylaster erubescens britannicus*

" *Thor* " 1904: W Iceland (material not located)
stn ?: 1904, 65°50'N, 26°53'W, 392m: Stylaster norvegicus, *Stylaster erubescens* (*groenlandicus* ?) (both *fide* BROCH, 1914a)

" *Travailleur* " 1882: S Bay of Biscay (material in MNHN)
drag.70: 28.8.1882, 43°59'N, 5°34'15"W, 1000m: *Pliobothrus symmetricus*

" *Triton* " 1882: between Faroes and Hebrides (material in BMNH, USNM)
3: 8.8.1882, 60°39'30"N, 9°06'W, 159m, SW Faroes Bank: *Stylaster norvegicus*

" *Tydeman* " 1977-1978, cruises CANCAP 2 and 3 (material in RMNH)
2.160: 10.9.1977, 27°36'N, 17°59'W, 550m, Canary Islands, S. Hierro: *Pedicularia* (stylasterid host unknown)
3.099: 23.10.1978, 30°07'N, 15°52'W, 585m, S Selvagem Grande: *Crypthelia* sp.

" *Vema* " 1961, cruise v17 (material in USNM)
RD-29: 9.4.1961, 60°27'N, 48°31'W, 326-366m, SW Greenland: *Stylaster erubescens groenlandicus*

" *Walther Herwig* " 1982, cruise 54 (coll. G. BEHRMANN; material in IMFB)
538-24: 24.9.1982, 65°25.2'N, 30°13.7'W, 700-713m, Denmark Strait: *Stylaster erubescens groenlandicus*

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